RAILROAD GAZETTE

FRIDAY, DEC. 1, 1893.

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Contributions.

Brake Rigging and Slack Adjusters.

TO THE EDITOR OF THE RAILROAD GAZETTE:

My attention has been called to a communication signed "Inspector" in your issue of Nov. 10, making comments upon a paper upon "Brake Rigging and Slack Adjusters" read by me before the Central Railroad Club at Buffalo and of which you published a synopsis in your issue of Nov. 3. "Inspector" accuses me of asserting that "the only place to take up the slack is at the cylinder," which he terms "one sided" and "prejudiced." If I had made the bald statement which I am here accused of doing I should deserve to be termed "one sided" and "prejudiced." I am sure, however, that "Inspector" is under a misapprehension. I presume what he complains of is the following: "Any effective adjuster must have two positive motions, a forward and a backward motion, and there appears to be but one place in which this motion is constant and invariable and that is in direct connection with the brake piston. It is here only that the adjustment can be made with the necessary positive motion forward and backward without the use of extra springs or other assistance to operate an automatic device." This occurs in my inquiry as to the most available point to apply an adjuster, and after fully discussing all other positions upon the pull rods and levers. The bald statement as quoted does not occur either in my paper or in your synopsis. I am sure if "Inspector" had heard the whole of the argument that preceded and followed these words he would not have written as he has done.

The question of the effect of causing a ranging angle upon the live truck lever mentioned by "Inspector" was fully discussed and illustrated by diagrams and was shown to possess no more objectionable features than those produced by throwing up the dead lever. I have seen instances such as those mentioned by "Inspector" where the live truck lever upon freight cars cannot be moved through a sufficient distance to wear out a set of shoes, but in all such cases the dead lever is equally restricted in its movement; therefore, even supposing the dead lever to be equipped with an adjuster, the only means of wearing out a set of shoes in such a case is to shorten up the bottom rod by hand, even with the use of such an automatic adjuster. I also referred to the fact that the first patent for an adjuster was applied for by George Westinghouse, and that it was in connection with the motion of the piston rod, as indicated in my paper. JAS. HOWARD.

Interstate Commerce Commission's Decisions on What Constitutes a "Through Arrangement."

TO THE EDITOR OF THE RAILROAD GAZETTE:

Permit me to call your attention to an omission in the report of the decision of the Interstate Commerce Commission in the case of Phelps & Co. versus The Texas & Pacific Railway, as reported in your paper of Nov. 10, page 828. The paragraph you have omitted is one in which good authorities claim that the railroad company's side has not been fully and fairly cousidered, and traffic managers will therefore be interested to know the facts. I refer to the second page of the conclusions in Commissioner Knapp's report, wherein he decides though the evidence shows the contrary, that the railroad company was a party to the through bill of lading. For the benefit of any reader who did not see the report I will here state that this was a complaint of overcharge in rate on cotton carried by boat on the Red River to Fulton, Ark., and there delivered to the Iron Mountain Railroad to go to New Orleans via the Texas & Pacific. The boat agent billed the cotton 50 cents a bale higher than the rate which he had named in the bill of lading. The Interstate Commerce Commission admits that there was no joint tariff and that there was in fact no tariff published by the boat at all. Previous decisions by the Commission are cited, including those in the cases of the James & Mayer Buggy Co., and the Board of Trade of Troy, Ala., to show the justice of thus assuming that a railroad accepting freight from another and paying the charges thereon thereby becomes a partner with such other road in a joint transaction. As you have shown the injustice of this view of the Commission, in in your comments on the two cases I have just named, I need not enlarge upon the matter further.

As further showing the "Dutch justice" principles on which this decision is based, I take the liberty of quoting the following paragraph from the decision:

"Moreover, we do not perceive how the defendant's case would be strengthened if its position as to our jurisdiction of the steamer line should be sustained. Even if the steamboat company was not subject to the law as to this transportation, the fact remains that the rail lines are subject to the statute, and that the defendant did demand of complainant higher charges than it was entitled to collect and retain for the joint account of itself and the Iron Mountain, upon a showing that the steamboat had made an overcharge above the amount it declared itself willing to accept in the bills of lading which it issued, and the subsequent action of the steamboat in refunding the overcharge is conclusive upon this point. Moreover, this whole case relates to the action of defendant in New Orleans, and its object is the discontinuance of a discriminating order which defendant would apparently have put in force just as promptly if the overcharge had been made by a connecting carrier concededly subject to the federal statute."

In other words, the road had done one wrong, and as it therefore deserved punishment, punishment is inflicted for another act which was not wrong. N. O.

Compound Locomotives.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In Mr. v. Borries' paper read before the Engineering Congress at Chicago, an abstract of which has recently come under our notice, the numbers of compound locomotives built and building, classified according to various systems, are given as:

Mallet	150
Worsdell-v. Borries	1,650
Webb	150
Vauclain	200
Others	50
Total	2,200

Although this classification does not show clearly what principle has been observed in separating the various compound locomotives, still the distinction of the Webb and Vauclain systems indicates that, under the heading of "Worsdell-v. Borries," all those engines have been included which have intercepting valves located in the receiver, whether or not they be so arranged tnat the compound working is suspended during starting.

If the total of 2,200 represents correctly the number of applications of the compound system which have thus far been made public, it would appear that Mr. v. Borries has included the whole of the Lindner locomotives, of which there are no less than 400 already running, besides nearly 100 now in course of construction, among the Worsdell-v. Borries engines, in which the intercepting valve, also employed by Mallet, has been adopted in all its various forms. We would therefore ask you kindly to grant us space for a few details as to the present position of the Lindner system, which has been thus entirely ignored by Mr. v. Borries in his enumeration.

The Lindner system (*vide Railroad Gazette* of Nov. 15, 1889, p. 743, and March 27, 1891, p. 207) must be acknowledged to be unique, since it requires neither an intercepting valve nor any starting cock having to be specially actuated by the engine driver, and attains its objects simply by an arrangement of the slide valves of the high pressure and low pressure cylinders, in conjunction with a four-way cock actuated by the reversing lever. For this reason alone it was deserving of a classification.

The total of 485 Lindner locomotives built and building comprises:

Sixty-seven express engines, including the heaviest type of express engine of the Pennsylvania Railroad (Vogt locomotive), and 22 six-coupled express engines on Russian railways.

Twenty-three passenger engines, including two for the Chicago, Burlington & Quincy Railroad.

Three hundred and twenty-seven goods engines (eight-coupled and six-coupled).

Fifty-two tank engines for standard and narrow gage lines, with four and six-coupled wheels.

Sixteen duplex locomotives (4-4), coupled wheels, for standard narrow gage lines (*Railroad Gazette* of Sept. 2, 1892, p. 646).

In view of the foregoing, it is difficult to understand how, in classifying the several compound locomotives according to systems, Mr. v. Borries comes to include the total of those constructed on the Lindner system among those of the Worsdell-v. Borries system. Either such is the case, or else the Lindner, although comprising more than 20 per cent. of the whole number of compound locomotives in existence, has been entirely ignored.

If the compound locomotives of the world, which, so far as has been made public, all only employ twofold expansion, are to be classified without regard to number and arrangement of cylinders, as in the case of Mr. v. Borries' table, this can only be done on the basis of the principles underlying the respective starting devices. On such a basis one group would comprise those systems employing an intercepting valve, and the other group those without intercepting valves, which groups could then be suitably subdivided, the Worsdell-v. Borries engines thus coming quite correctly under the former category, which is headed by the Mallet engines.

In no case, however, can there be any justification for calmly including among the total of Worsdell-v. Borries engines the locomotives of the Lindner system—whose considerable number must be at least approximately known to Mr. v. Borries, or at any rate could have been easily ascertained by him—or for completely ignoring in the enumeration the ingenious and successful device of Mr. Lindner. HOPE & CO.

The English Channel Bridge.

The Channel Bridge & Railway Company has recently published a detailed description of a new project for a double track railroad bridge across the English Channel. It is based on a careful survey of the Straits of Dover and has had the collaboration of Messrs. Schneider and Hersent and of Sir Benjamin Baker. The designs differ considerably from the plans which the above company exhibited in Paris in 1889.

The new bridge will cross the channel in a straight line, landing at either end near Dover and Calais. It will consist of 73 spans of 1,313 ft. and 1,640 ft. alternately, with a minimum clearance of 177 ft. above high water and will have a length of 20¾ miles between the two shores. The mean depth of water below lowest spring tides is 120 ft. and the maximum depth is 167 ft.

Along the whole of the adopted line the bottom of the straits is a level cretaceous rock, which is perfectly scoured by the alternate tides. There is no mud over the rock.

The visible part of the piers will consist of oblong towers 66 ft. wide and 148 ft. long, faced with cut granite and reaching 46 ft. above high water. These piers support a pair of braced metal columns destined to carry the trusses. The towers will rest on a base of masonry to be constructed in depths of not over 108 ft. by means of metal caissons surmounted by metal cofferdams. The bottom dimensions of the caissons are to be 98 ft. by 175 ft., and the space between the level of the cutting edge and the roof is divided by partitions into a number of working chambers of about 590 sq. ft. area each. The caissons are to be held in position by hawsers from a circle of anchored pontoons. For depths over 108 ft. it is proposed to prepare a foundation of concrete on a previously leveled bottom, submerged in layers of 8 ft. to 10 ft. thickness, deposited in metallic cofferdams of decreasing dimensions, placed one above the other. The concrete will be carried up to within 100 ft. more or less from the surface, and the foundation completed by sinking a caisson like those above described on this bed of concrete. For a few piers, which go down to greater depths, a foundation will be effected by the submersion of artificial blocks by the aid of movable metal platforms. These will be established over the site of the pier, resting directly on the bottom of the sea by means of four hollow legs sliding in sheaths 100 ft. long, to accommodate themselves thus to varying depths. The section of the legs is a square of 13 ft., terminating in two semi-circles of 6½ ft. radius, making them 26 ft. in the direction which requires the greatest resistance. The complete metal platform will weigh about 2,800 tons, which weight will be sufficient to insure stability under the most violent shocks by waves and storms. Into 18 slots of the platform are fitted square latticed columns, which rest on the rock bottom and form an oval somewhat smaller than the pier. Between these columns and guided by them are to be lowered blocks of artificial stone of average dimensions of 23 ft. by 16 ft., 10 ft. high. These blocks are to be made to fit exactly into each other when placed side by side and to constitute the outer wall of the pier. The rock bottom having been leveled beforehand the first layer of blocks will be bedded by means of bags of fresh concrete, tied to the bottom of the stones. The heaviest of the blocks will weigh 150 tons. The union of the different vertical lines of blocks is to be obtained by pouring concrete into the guiding columns, through the latticing of which it will flow into the joints. The inside of the pier is to be filled by dry rubble stone compacted by the injection of liquid cement under high pressure through tubes from the platform.

The superstructure is to be composed of two lattice trusses joined at their top chords, so as to be triangular in cross section. The trusses will extend over the whole length of the 1,313 ft. spans, being prolonged on the cantilever principle for 615 ft. on each end of the latter into the 1,640 ft. spans. An independent girder of 410 ft. length will be suspended between each two cantilever arms. The width between the bottom chords of the 1,313-ft. trusses will be 82 ft. which will be diminished gradually in the cantilever arm to 33 ft., which will be the width of the 410-ft. span. The depth of trusses will be 200 ft. over the piers, and decrease to 130 ft. in the center of the 1,313-ft. span and to 35 ft. at the beginning of the 410-ft. span. The latter will have a parabolic top chord with a maximum depth of 66 ft. The bridge will carry two roadways about 33 ft. above the base of the triangle which is formed by the trusses. The rails will run in channels, providing against derailment, and the roadway will be covered throughout with an iron platform. Each line of rails will rest upon a longitudinal lattice

girder, supported at intervals by transverse girders in the shape of a trapezium, of which the large base will be connected with the bottom chords of the trusses. For the erection of the superstructure the movable metal platforms, which have been previously described, will be utilized.

The location of the bridge is to be indicated by electric incandescent light signals during the night, sound signals during fog and warning signals consisting of rod buoys as to approaching piers.

The estimate of cost is based on the supposition that the construction will occupy seven years. It amounts to $43,200,000 for 4,700,000 cubic yards of masonry; $91,200,000 for 760,000 tons of superstructure; $400,000 for approaches; $2,000,000 for installation of lighting and buoying; $6,800,000 for plant in harbors and management; $20,100,000 interest on capital during construction; together making a total of $163,700,000. An annual income of $16,300,000 is expected from freight traffic, and of $3,400,000 from passenger traffic, paying, after deducting for interest, operating expenses and a sinking fund a yearly dividend of 10 per cent. on the capital stock.

Moving Track on the New York, New Haven & Hartford.

We give below an account of the method by which Mr. C. C. Elwell, M. Am. Soc. C. E., Roadmaster of the New York division of the New York, New Haven & Hartford, has lately moved several long pieces of track at very low cost. As most of our readers know, this road is spending several million dollars in improving its line between Woodlawn, the western terminus, and New Haven. The whole of this—61 miles—is to be made a four track road. The steep grades, of which there are many, are to be reduced to a maximum of 30 ft. per mile and nearly all the curves are to be reduced to 2 degrees, the maximum being 3°. The country is very rocky, and in many places the improvement consists in making an entirely new line for a considerable distance. As the work progresses all highways crossing the line are carried above or below the tracks.

After settling the usual engineering and right of way problems, there still remain many difficulties in the execution of details on account of the large passenger and freight movement, and it is one of these and the method of meeting it that we now describe. The work of blasting, excavating, changing grades and putting in new bridges has to be done without interfering with the daily movement of 67 passenger trains, besides many freights, and close study is required to minimize delays to the workmen and afford absolute immunity from accidents. For instance, no material, either for use or waste, is moved across the tracks used in operating the road, although as the new line crosses and recrosses the old, such movement would simplify and cheapen the work.

This description refers to the shifting of one track from the old to the new line and grade just east of Milford, Conn., 64 miles from New York.

Fig. 1 is a map and profile of the changes. The change in alignment is too small to be shown on a plan of this scale. The changes in grade extend 8,900 ft., with an average raise of about 6 ft. and a maximum of 9 ft. The filling for the third and fourth tracks had been brought to the new grade by contract work, and the two original tracks are to be raised later to correspond. Under former plans the track was raised by a succession of such lifts as could be properly tamped so as to permit the safe passage of frequent trains. As now done the two existing tracks are moved bodily on skids from the old to the new grade, making the new third and fourth tracks, and the old portion of the roadbed is then raised without interference from trains.

The proposal to raise and slide the tracks on skids, with block and tackle, was so universally condemned by experienced trackmen that an experimental test on one length of track was made by Mr. Elwell. This was so satisfactory that he determined to go ahead in spite of adverse criticisms. Twelve skids in all were made, six each of two different lengths, the short for the lower and the long for the higher portion of the new embankment. These skids consisted of rails spiked to 6 in. × 8 in. spruce timbers, with dowels at each end to which were attached the blocks and tackle.

The work of moving one track (8,930 ft. long) was done on Sunday, Oct. 22, and a force of 261 men was distributed as follows: Charles Shackett (35 men) to raise tracks ready for skids, using six jacks to a section, and make east connection. J. T. Reilley (150 men) to move track in five-rail sections to top of bank; then unload ballast and roughly surface the track. John O'Leary (75 men) to follow Reilley, making connections and lining and surfacing track. Conductor Dean transported men from Bridgeport and New Haven, and during the progress of the work ran back and forth on eastbound track distributing material. The light train movement of Sunday was all turned upon the eastbound track. The work trains started about 5 a. m. and work began at 7.

The track was disconnected in five-rail lengths, as shown in fig. 5, a plank being spiked to the ties from *A* to *B* to keep them in position, and the men were distributed as shown in that drawing. The continuity of the work was interrupted by two bridges. At these points the track was disconnected, so that the sections opposite the bridge structures could be left until the spikes could be drawn and the rails laid and spiked to line on the floors of the new structures. Before blocking the track ready for the skids, Foreman Shackett drew the spikes which fastened the rails to all worthless ties.

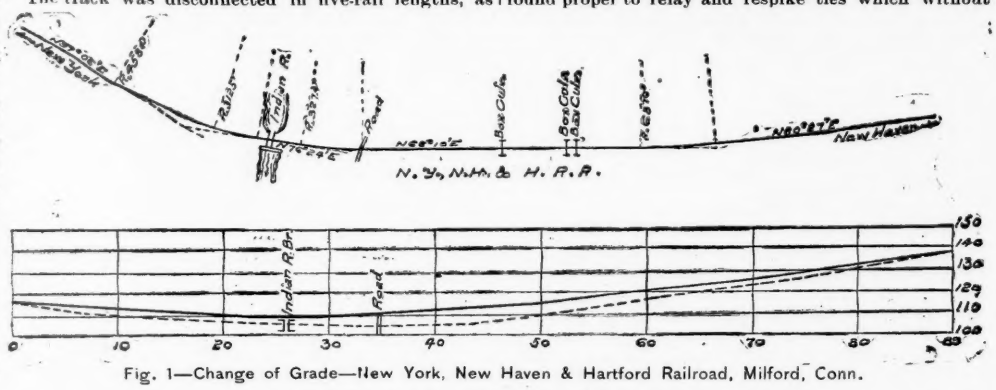


Fig. 1—Change of Grade—New York, New Haven & Hartford Railroad, Milford, Conn.

Note: Full line, new grade; dotted line, old grade.

At 10 a. m. an interval was allowed for luncheon, consisting of sandwiches, coffee and apples, provided by the company. After luncheon Reilley's gang skidded and lifted to place the last 15 sections of the track in 45 minutes, an average of three minutes for each section of 150 ft. of track, and the lifting was finished by 11:59 a. m.

The two curves and the bridges necessitated moving some sections longitudinally. As the new embankment consisted mainly of gravel, properly leveled off, the forces under Reilley and Shackett were in the afternoon concentrated on the work of surfacing and lining the track. At 5 p. m. the track was turned over to the operating department. This track has since been in constant use, and two weeks later the eastbound track was similarly lifted to its place.

The work of shifting 8,900 ft. of track a distance varying from 20 to 30 ft. and lifting it an average of 6 ft., and putting the same in condition for train service, required 261 days' work; but an allowance was made on the payrolls to cover the time going to and from the work, many of the men being brought from a distance. Of the 261 days' total work, the gangs of Shackett and Reilley, aggregating 186 men, worked but one-half day in the actual shifting of the track to position. From this it appears that after adding the time required to couple the sections of track together, a little more than 100 full days' work sufficed to place the track in position for surfacing. This work was equivalent to that which under the usual methods, would be necessary to draw the spikes, disconnect the rails, and to carry the ties and rails 25 ft., including the lift of 6 ft., after which it would be necessary to space and line the ties, and to connect, gage and spike the rails. Nor was the saving confined to the labor involved. The inevitable loss of spikes, bolts, etc., in such hurried work is generally large, to say nothing of the breakage of spikes in drawing and redriving. There is also considerable saving in ties, for it is a question whether it would have been found proper to relay and respike ties which without such respiking might be good for one, two or three years.

Four miles of track has since been raised in this way.

Fig. 2—Track Jacked Up Ready for Skids.

Fig. 3—Track Pulled Part Way Toward New Grade.

Fig. 4—Cross-Section at Pelhamville.

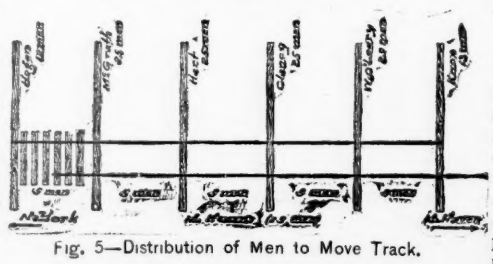


Fig. 5—Distribution of Men to Move Track.

On a previous Sunday, Oct. 8, a length of about 4,600 ft. of the westbound track had been moved, between Pelhamville, N. Y., and Mount Vernon, the general plan of operations being as described above. The accompanying engravings, figs. 2 and 3, made from photographs, were taken during the progress of this work. At the highest point the new grade was 8 ft. higher than the old; and the lateral movement was 35 ft. The cross section, fig. 4, shows the relative positions of the old and new tracks at a point where the embankment is highest. The track on the new grade was to be temporary in any event, as the embankment was to be further widened, and it was decided to allow time for further settlement before putting in broken stone ballast. It was therefore inadvisable to use new rails, and if the old track had not been moved it would have been necessary to bring second hand rails from other points on the road. The men were distributed as described, and the track was broken into five-rail lengths. The method of doing this and the distribution of the men are shown in fig. 5. The natural rivalry between the different subgangs in getting the track properly jacked up and blocked and going back for jacks and blocks previously used, made the work lively and interesting. At Pelhamville the work was begun at 7:30 a. m., the track was all raised by 11 o'clock, and the lining and tamping were finished at four. Eighty-two cars of ballast were used. The cost of this job equaled about 20 cents per lineal foot of track. In moving the eastbound track, Nov. 5, the cost was reduced to about 16 cents a foot.

The Lehigh Valley Strike.

The strike of trainmen and telegraph operators on the Lehigh Valley has failed, though the company has evidently had a hard struggle to avoid a serious blockade of freight. The company has continued its policy of giving out only brief statements of the condition of affairs, while the leaders of the strikers have said nothing except to repeat their usual phrase about the hopeful aspect of things. Many new men hired by the company have been induced to leave after working a day or two, while on the other hand a few of the old men have come back. Some new men have burned locomotive boilers, and the strikers report that cases of this kind have been very numerous. As the officers of the road make no replies to most of these statements it has been hard, even for reporters who traveled over the line of the road, to get an accurate idea of the condition of affairs. General Manager Voorhees reported on Monday of this week that 6,348 freight cars were moved on Saturday and Sunday. This was a much larger movement than had been accomplished before since the strike began, but it was not stated how it compared with the normal movement. The fact that the com-

pany on Monday notified its connections that it was ready to receive freight as usual indicates, however, that the chief trouble is practically over. On Tuesday the recruiting offices which had been opened in Philadelphia and elsewhere were closed.

The worst difficulty in putting the new men at work has been the lawless interference of strikers and their friends, various idle persons. The sheriffs and their deputies appear to be rather timid, and the new employees manifest the same disposition. A dispatch of Monday said that an engineman at Pittston Junction drew a revolver and held the mob at bay while he pulled his train out of the yard, but this is an exceptional item. In scores, if not hundreds, of cases, though "no violence was offered," new enginemen and trainmen were intimidated so that they either left their work or submitted to long delays. The following from the New York *Sun* of Nov. 27 is a sample paragraph out of the columns of matter printed:

WILKES-BARRE, Nov. 26.—The men and boys who have been thrown out of work by the strike are getting more troublesome, and it is possible that the railroad officials were right last night when they predicted serious things, a prediction, by the way, which they took back to-day less than half an hour before trouble did really begin. On the outskirts of Wilkes-Barre and at Sugar Notch and Coxton at intervals during the afternoon there have been rows, which very little work might have increased to actual riots. Trains and engines have been stoned, windows smashed and boilers injured; signals have been destroyed and men intimidated. To-night 10 extra policemen are on duty guarding the Lehigh Valley station and a crowd of 300 or 400 persons is there at this hour, 8 o'clock, shouting and skylarking. The people in it don't appear to be in ugly temper, but many of them are ready to partake of any little devilry that may be suggested. It is not likely that there will be serious trouble to-night, however. The crowd is made up chiefly of laborers. There are a few strikers among them, but not many.

Men have been arrested at several places for throwing stones at telegraph operators and non-union men, both while on duty and at their dwellings.

There have been a number of slight collisions and two or three more serious ones, but no bad casualties to persons are reported except in the case of a locomotive boiler explosion at Burdett, N. Y., where an engineer was killed and in a crossing collision at Perth Amboy where a new engineer who, according to the reports, was responsible for the collision, was killed.

The Sheriff of Bedford County called on the Governor of Pensylvania for militia to keep order at Sayre and other points, but the Governor thought that the Sheriff had not made full use of the civil power at his command and declined to order out the soldiers. There seems to have been a force of guards, more or less adequate as regards numbers, at all important points, but it is difficult to say how efficient they were; and, as intimated above, much of the lawlessness was of a kind that nothing less than a full military guard could prevent. At Jersey City the company seems to have had ample protection from the police, and guards travelled with all of the trains for a while.

The reporters, gathering their information from strikers, have continued to say a good deal about the refusal of other roads and of the employees of other roads to receive freight delivered to them by the Lehigh Valley, but it does not appear that there has actually been much, if any, of this illegal refusing; while, on the other hand, numerous instances are reported of other roads receiving freight in the usual manner as though nothing had happened. The passenger business of the Lehigh Valley has undoubtedly been very light since the strike began. Milk dealers were considerably inconvenienced at Philadelphia and also to some extent at New York City. On Friday last certain coal shippers tried to intercede with the road in behalf of the strikers, but their efforts were fruitless. On Monday of this week the members of the State Boards of Arbitration of New York and New Jersey joined in asking President Wilbur to place his case before them, but he replied that there were no differences between the road and its employees.

Passaic Drawbridge—New York, Lake Erie & Western Railroad.

Herewith is given an illustration of the draw-span of a bridge over the Passaic River on the main line of the Erie. Fig. 1 shows in considerable detail the design of the bridge and its special features. Attention is called to the attachment of the floor beams to the posts, the lateral bracing and the seating of the posts *E* and *F*, as if they were end posts, *i. e.*, without pins. The peculiar and most novel feature is the upper chord connections in the center panel over the turntable. It is a device to lift the two ends of the drawbridge entirely off their bearings.

Generally the two ends of a drawbridge are not lifted previous to turning the same. The wedges at *A* are simply withdrawn and the ends are allowed to deflect. When the bridge is closed an attempt is made to raise the loose end of the bridge by forcing the wedges sufficiently to give them a solid bearing. This is deemed necessary to prevent the tipping up of the unloaded arm of the bridge when a train passes up on the other end.

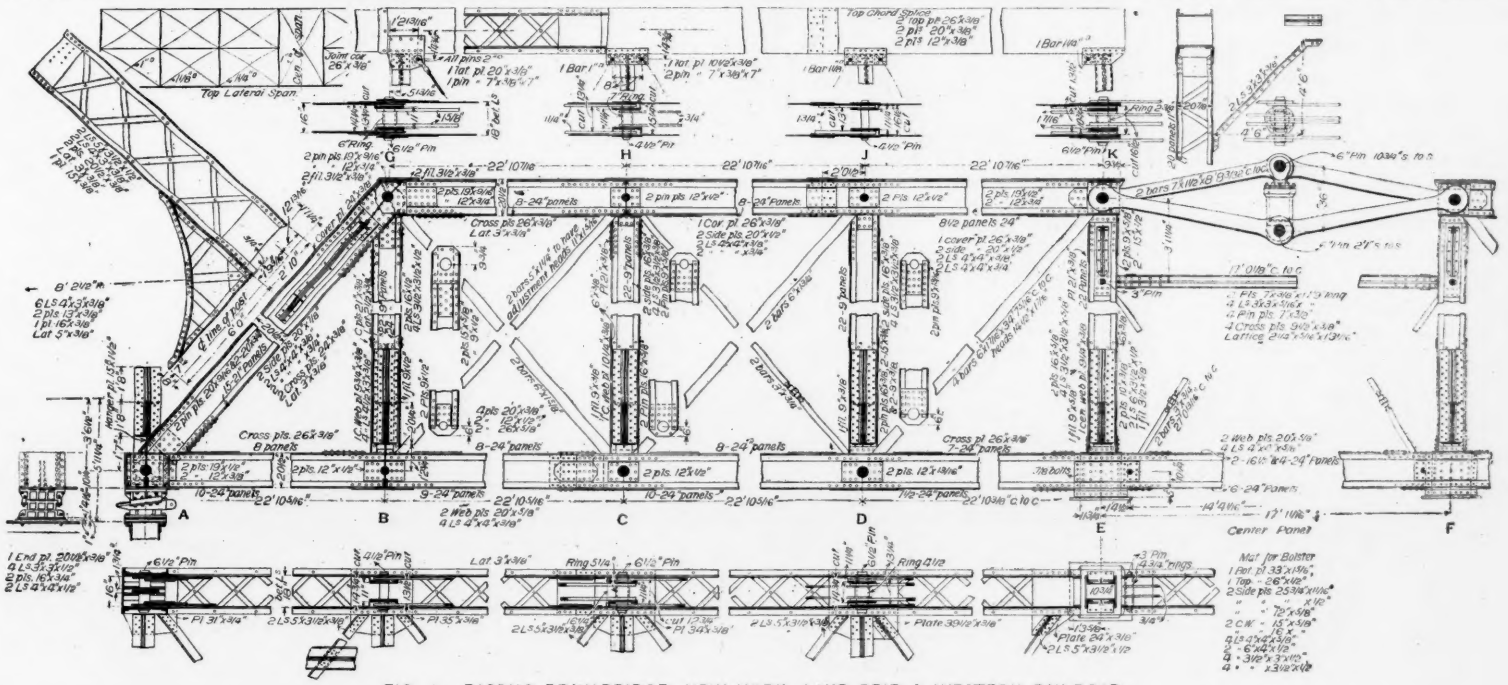


FIG. 1.—PASSAIC DRAW-BRIDGE, NEW YORK, LAKE ERIE & WESTERN RAILROAD.

C. W. BUCKHOLZ, *Chief Engineer.* UNION BRIDGE COMPANY, *Builders.*

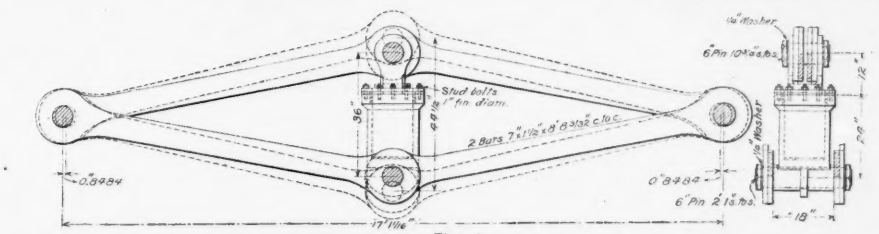


Fig. 2.

he failure to accomplish this result by means of wedges has long since been admitted, and the strains of the different members of a drawbridge resulting from this failure cannot be accurately ascertained, since they vary with every position of the wedges.

It is very desirable to know these strains absolutely, especially under the present heavy loads of modern rolling stock and locomotives, and that knowledge can only be had by having always the same bearings or reacting conditions of the bridge. In designing this drawspan it was determined to have but two conditions of support for the bridge; one when the draw was open and not in service, and the other when it was closed and in service. Under the latter condition a drawbridge should be nothing more or less than a bridge of two fixed spans without any strains upon those members over the pivot pier. This result can be obtained by two means, either by raising the ends or by lowering the whole structure bodily and pivoting each arm at the foot of the end post resting on the center pier. The latter method was adopted for the Passaic draw, and the object was accomplished by the simple method of connecting the top chords of the two arms across the pier by a toggle joint of linked bars hinged upon pins and separated vertically into the shape of an oblong diamond by means of a hydraulic jack (see fig. 2). This hydraulic jack is operated by a pump driven by the same engine that turns the bridge, and when the pistons of these jacks are forced out the depth of the diamonds is increased and their length shortened, thereby raising the loose ends of the arms so that the wedges can be withdrawn and the bridge turned. The bridge has now been in operation for a year and a half, and has given entire satisfaction.

Production of Heavy Forgings in the United States.

We mentioned last week the excellent paper on the Production in the United States of Heavy Steel Forgings for Engines, Guns and Armor Plate, presented at the meeting of the Society of Naval Architects and Marine Engineers, in New York City, by Mr. Russell W. Davenport, Associate of the Society. An abstract of the paper follows:

Five years ago there was no forging plant in the United States with facilities for making the heavy steel forgings required for modern marine engines, for cannon of the larger calibres, or for armor plate. Heavy shafting and the like for engines had, in general, been made of wrought iron and great skill had been attained in making them of large dimensions. But wrought iron forgings have a low elastic limit averaging not over 20,000 lbs. per square inch, and while with care they can be made tough and uniform the danger of bad welds and porous spots increases with the dimensions of the forgings.

The French works led in the development of the use of open hearth steel for heavy forgings, and in 1877 the Creusot Works had an open hearth plant capable of casting an ingot of 110 tons and had a 100-ton hammer for forging. In England, while heavy open hearth forging made rapid progress, the manufacture of forged steel armor plate was not attempted and no hammer of over 40 or 50 tons falling weight was constructed. The firms of Vickers & Co. and Charles Cammel & Co. are mentioned as producers of heavy, open-hearth forgings for guns and shafting which, until recently, were made under the hammer.

But Sir Joseph Whitworth & Co., of Manchester, led the world in the art of making open-hearth steel forgings, except for armor plate. The two distinct improvements made by that company were, first, subjecting the fluid steel immediately after casting and during solidification to a heavy hydraulic pressure reducing piping and segregation to a minimum and doing away with blow holes and cracks; second, the substitution of the hydraulic press for the hammer. As a result of the press came the possibility of forging hollow, on a mandril, long lengths, for gun tubes, shafting, etc.

In the United States little progress had been made up to within five years in making the heavier classes of steel forgings. The Midvale Steel Company produced excellent forgings for steel guns of 6-in. calibre and below, and had produced one set of forgings for an 8-in. gun. About two years ago the company put up a hammer of 40 net tons falling weight and contracted to furnish forgings for 10-in. and 12-in. cannon.

In 1885 the Bethlehem Iron Company determined to establish a forging plant of the first order, and finally, chiefly through the efforts of Mr. W. H. Jacques, then a lieutenant in the United States Navy, succeeded in making a contract with Sir Joseph Whitworth & Co. for machinery and information. The principal items of this contract were two hydraulic forging presses, complete with engines and pumps, one of 1,500 and one of

4,500 tons capacity, with two hydraulic traveling forging cranes and other necessary appliances for each press; a complete fluid compression plant, including press of 7,000 tons, a 125 ton hydraulic traveling crane (the upper and lower heads of the press, weighing 135 and 120 tons, were made in Bethlehem); some large machine tools; designs of open-hearth furnaces and special tools, and an agreement to furnish full information as to methods and shop practice and to send skilled men to Bethlehem to superintend the erection and starting of the machinery. The Bethlehem company, however, erected and put the plant in operation with its own employees. It was agreed that all the machinery furnished should represent the latest experience of the Whitworth company, and should be equal in design and execution to similar machinery built new for their own works. It is believed that this agreement was strictly carried out, thus making the Bethlehem plant superior in many respects to the one at Manchester. The money value of this contract has rarely, if ever, been exceeded by a single order given out by a private concern.

In 1887 the company signed with the Navy Department a contract for about 1,300 tons of steel forgings for heavy guns and 6,700 tons of steel armor plate, and the first gun forgings were produced in the fall of 1888. The company decided to make the armor plate by hammer forging, and had already contracted with the Creusot company for necessary drawings and information and for rights to manufacture under all patents covering armor plates. This contract involved of course a heavy compensation to the Creusot company. A hammer was built of 125 tons falling weight instead of 100 as at Creusot. The steam pressure was increased from 75 lbs. to 125 and other improvements made. The first armor plate was forged in the summer of 1891, a little over 2½ years after actual work on the plant had been begun, and the plant is to-day at the head of the great hammer forges of the world. But the Bethlehem management decided to build a larger forging press and as a result a double cylinder forging press of 14,000 tons capacity with pumps driven by 15,000-H. P. engines was designed by Mr. John Fritz and Mr. E. D. Leavitt. This press is now completed, and constitutes with its furnaces and hydraulic traveling cranes the most complete and powerful forging apparatus in operation. From an enneering point of view this great work is the creation of Mr. Fritz and a fit monument to his genius and energy. As a business enterprise it testifies to the faith and pluck of the Board of Directors and their General Manager, the late Dr. G. B. Linderman.

Having outlined the development of the plant Mr. Davenport discussed the following topics: (1) The cast. ings of ingots. (2) Conditions of shaping or forging 3) Treatment after forging. (4) Introduction of unusual ingredients into the steel.

First. Under the first topic he treats of the well known difficulties of casting steel ingots, the most efficient remedy for which is the Whitworth fluid compressing process now in daily use at Bethlehem. Masses of steel of great weight are produced now which are to a high degree sound and homogeneous, and which prepared by boring for hollow forging are practically free from all defects.

Second. The internal strains and defects which cause the failure of many forgings can be attributed to the use of hammers of relatively high velocity and small weight. The flowing of the metal throughout the whole mass requires time. Repeated blows of a light hammer stretch the exterior more rapidly than the interior, producing internal strains and at times actual cavities. The ends of forgings made under these conditions are concave or cupped, due to the exterior drawing more rapidly than the interior. With the hydraulic press a definite, constant, slow pressure is secured which distributes itself and causes flowing throughout the entire section; and under the forging process in the Bethlehem shops one sees the slow and continued flowing of the metal as evidenced by the convexity of the ends as against the concavity produced under a comparatively light hammer. A heavy hammer falling by gravity alone of course produces the same result, but to a less degree. An important element in the use of the hydraulic press is hollow forging over a mandril. Boring a hole through the long axis of the ingot removes the defects of segregation and piping and discloses interior defects. The smaller cross section of the walls of this cylinder facilitates heating and insures thorough working of the material under the press; thus it is possible to turn ont the forging at a low uniform heat and a fine or amorphous grain.

Third. Mr. Davenport describes the effects of annealing and tempering and says that comparatively little has yet been done toward treatment by tempering of marine shafting and engine forgings, but it is believed that a large field for improvement is open to the marine engineer in this direction.

Fourth. This division of the subject naturally treats especially of the use of nickel. The probable superiority of nickel steel for armor was early brought to the attention of the Navy Department, and in 1890 the Secretary authorized the purchase from the Creusot company of two 10½-in. plates, one simple and the other o nickel steel. A Cammel compound plate of the same dimensions was procured and in the trials, as is well known, the nickel steel plate proved superior especially in its freedom from cracks; and nickel steel was adopted for armor by our navy. The Bethlehem company and the Carnegie company undertook the manufacture of nickel steel armor which is now produced regularly in large quantities. A steel containing about 3¼ per cent. of nickel has been generally used for armor plate and much information as to its qualities has been obtained. In general this percentage of nickel increases the tensile strength and elastic limit without causing a corresponding reduction in elongation and contraction. The elastic limit is also increased relatively to the tensile strength. This amount of nickel appears also to favor a finer granular condition after forging, and it renders the steel more susceptible to the effects of tempering. In all respects it improves the physical qualities of mild steel. Hence there is a wide field for the use of nickel steel, not only in armor plate, but in gun and engine forgings, as well as in many other products. A complete set of forgings for an 8-in. gun made of nickel steel has been sent by the Bethlehem company to the Bureau of Ordnance, United States Navy, and these are being assembled at the Washington Navy Yard. Specimens from these forgings show an increase of about 10 per cent. in the tensile strength and of 22 to 28 per cent. in the elastic limit, and but a slight reduction of elongation and contraction of area as compared with navy gun forgings of simple steel. The average physical qualities obtained from specimens of forgings 2½ in. in diameter and 2 in. long are as follows:

	Tensile Strength. Lbs. per sq. in.	Elastic Limit. Lbs. per sq. in.	Extension. Per cent.	Contraction of Area. Per cent.
Tube.....	93,200	58,300	21.2	42.0
Jacket....	99,000	60,000	20.4	45.9
Hoops	109,100	68,200	20.5	46.9

The army has also ordered a tube for a 12-in. gun of nickel steel.

For modern marine engines reduction of weight is of prime importance. This means reducing sectional areas, but reduction of outside dimensions means less stiffness, and we are led therefore to hollow forging. This has been followed in the shafting of all the ships of the new navy except the four Roach ships. In most cases the diameters of the axial holes have been too small for forging hollow on a mandril; consequently, the shafts have been forged solid and bored, with a distinct loss in the quality of the metal.

The ideal material for engine shafting seems to be nickel steel, forged hollow, oil tempered and annealed, and indeed this is a material of which engine forgings may be made with great advantage. The Bureau of Steam Engineering of the United States Navy has decided to make the two propeller shafts of the Brooklyn and the two intermediate line shafts of the Iowa of nickel steel. The Brooklyn's shafts will be 17 in. outside and 11 in. inside with walls three inches thick. The line shafts of the Iowa will be 15¾ in. outside and 9¾ inside, the walls also three inches thick. These are to be oil tempered, to have a tensile strength not less than 85,000 lbs. per square inch, an elastic limit not less than 50,000 lbs., an average elongation of 23 per cent. in specimens two inches long.

Prof. Mansfield Merriman has compiled a table comparing the strength of these shafts, within their elastic limit, with solid shafts of the same sectional area, of simple steel, with an elastic limit of 30,000 lbs., also comparing their weights per linear unit with soft steel solid shafts of equal strength. It is found that the hollow shafts made of the stronger steel give a gain of 3 to 1 in strength and a reduction of one-half, as compared with solid, soft steel shafts of equal weight and equal strength respectively. It must be borne in mind, too, that this gain is accompanied by extreme toughness.

Wheel Flanges and Guard Rail Clearances.

By George Tatnall.

All maintenance of way men expect and are expected to maintain an established gauge of tracks inviolate and absolute. They also expect the wheel gauge designed to run on this established track to be just as inviolate and absolute. As a beginning to produce some systematic regulations from the multiplicity of customs and opinions as to the proper gauge of wheels and proper allowance of play on the track that prevailed in the early history of railroads, the Master Car Builders' Association at its first annual convention held in September, 1867, brought the matter up, and adopted as the sense of the convention "that 4 ft. 8¼ in., as understood by car masters, is the proper width at which wheels should be gauged for cars running on compromise gauges," the entire discussion, as well as the final action, betraying no variation from the primary principle of gauging the wheels to the gauge of the track.

At the fourteenth annual meeting, held July, 1880, the president called attention to "the varions lengths of gauges used for setting wheels for the same gauge of track." After an extended discussion during that session and the following one a year later, a partial report from the committee was adopted by a large majority recommending a difference of ¾ in. between the gauge of track and the wheel gauge. The entire discussion during each year and the final action, again recognized and emphasized the same primary principle of gauging the wheels (with proper play) to the gauge of the track.

At the sixteenth annual meeting, held in June, 1882, the same committee which had been continued confessed themselves unable to agree on a standard wheel gauge. After citing and agreeing with the specially obtained opinions of prominent civil engineers and trackmasters "that we must gauge our wheels to conform to their track,' they continue: "One of the principal discussions at our annual meetings has been how to make the gauge of wheels for a 4 ft. 8½ in. track conform to all other gauges from 4 ft. 8¾ in. to 4. ft 10 in., and your Committee cannot suggest, and do not deem it prudent, safe or consistent to suggest, such a gauge."

Nevertheless,. contrary to the advice obtained and agreed to , they continue. "The Committee are unanimous in their opinion that the wheels should be gauged between the flanges on the inside of the wheel, as this point remains fixed and governs the position of the distance in guard rails, while the wear on the front of flanges changes their shape, and it leaves no definite point to work from when refitting old wheels." In connection with this report was submitted, among others, a gauge as shown in fig. 1, to be used in mounting the wheels on their axles. It was produced by the principal advocate of this method and evidently a representative of a road using 4 ft. 8½ in. gauge of track, and both it, in its dimensions, and the remarks made in offering it, while containing a distinct recognition of the importance of gauging the wheels to the track, and while proposing to establish standards which the Committee had just declared it "not prudent, safe or consistent to suggest" make the first direct proposition to depart from the principle of regarding the wheel gauge as absolutely fixed as the track gauge.

The opponents of this innovation, while alleging the true surface and outline of the tread and running side of flange as fitting that side to be measured from, pointed out the variations of gauge that would result from the accumulations of the irregularities due to bad iron, imperfect molding, bad workmanship, etc., on the back of the wheel, making much depend on the care of the maker in excluding warped or swelled backs from his finished products. Its advocates, while admitting all these objections, claimed increased facility and quickness of mounting, and also that the sum of all these admitted imperfections would produce variations of gauge less in amount than that produced by differences of opinion as to the proper play on the track, and, further, that with the proposed mounting gauge (see fig. 1) the gauge of the wheels could be tested if desired after the mounting was completed. With these arguments the new method was carried and the standard distance between the backs of the wheels was fixed at 4 ft. 5¼ in.

This decision, as it indirectly established a standard which the Committee had refused to suggest, gave rise to a controversy in succeeding meetings between representatives of roads using wider and narrower gauges of tracks, and at subsequent meetings it was amended to 4 ft. 8⅝ in. as a compromise, and again amended so as to allow ⅛ in. variation each way from that standard, but neglecting to specify that a road using a smaller gauge of tracks should use the minimum, and one using a larger gauge of track the maximum standard thus produced, which, by the spirit of the argument and the grounds for the controversy, must have been the intention; thus adding ¼ in. to the already admitted variations of the wheel gauge, and for the first time entirely discarding any plainly expressed regard for the relation of the wheel to the gauge of the track, and for the first time permitting a careless foreman to mount a pair of wheels that would not run on the track, as we shall see presently.

In the meantime the maintenance of way standards had gravitated toward uniformity, the variety of track gauges had narrowed down to 4 ft. 8½ in. and 4 ft. 9 in. The maximum distance over guard rails had been fixed at 4 ft. 5 in. for all gauges. The rail heads had been given clearer and sharper outlines, which became more nearly alike on all roads, so that a gauge of 4 ft. 8½ in. meant the same whenever mentioned.

The result being a clear, uniform and accurate gauge of track whether 4 ft. 8½ in. or 4 ft. 9 in.

Among the rules for interchanging cars which the M. C. B. Association were called on in 1886 to promulgate was the following clause for which cars might be refused. As introduced it read, "Wheels out of gauge, or that measure less than 4 ft. 5 in. between flanges, or less than 5 ft. 4 in. over treads." In the discussion of this article it was pointed out that it was just as important not to get the flanges too far apart as not to get them too close. On behalf of the Committee the reply was that the phrase of the section "out of gauge" was intended to cover the point raised, which it undoubtedly would have done had not the fixed and absolute gauge of wheels as compared to gauge of tracks been step by step departed from and neglected. The convention voted by a large majority that the phrase did not cover the point, and it was amended so as to read, "Wheels out of gauge, or that measure less than 4 ft. 5 in. or more than 4 ft. 5½ in. between flanges, or less than 5 ft. 4 in. over treads." This was changed in the report of the next annual meeting, by what authority does not appear, to a maximum of 4 ft. 5¾ in. instead of 4 ft. 5½ in. Thus was officially buried the last remains of the idea of a fixed wheel gauge.

At the same meeting was adopted a standard form of tread and flange for car wheels, as shown in the diagrams, and of which more will be said later.

While we have briefly noted the increased uniformity, accuracy and definiteness of the track gages, we have

carefully traced the successive steps by which the fixedness of the gage of wheels has been gradually deviated from and finally abandoned; how rules have been adopted allowing a careless foreman to mount wheels on their axles with sufficient differences of gage to make doubtful their traveling safely on his own road, and how rules have been adopted for inspectors at junctions, practically compelling them to accept cars which may have come to them over a road of 4 ft. 9 in. track gage, and which might not be able to run on his road at all, as we shall see presently.

Let us now examine the thickness of the M. C. B. standard wheel flange and its position in regard to the rail head. See fig. 2.

An examination of the standard rail sections of the leading roads of the country shows these general features: An inclination toward the vertical of the two plane sides of the head, varying from 0 deg. to 4 deg., or 0 in. to 1/8 in., a long radius to the top surface, and a radius at top corners varying from 3/16 in. to 5/8 in. The figure shows a type of the extreme in slope of face and radius of top corner, this being the most favorable to the prevailing method of mounting wheels. The rail section recommended by the meeting of the American Society of Civil Engineers, recently concluded, shows vertical sides to head and 5/16 in. radius to upper corner.

The thickness of the M. C. B. flange is usually spoken of as 1¼ in.; this is measured at a point 5/8 in. below the head. This definition seems to have arisen from a section of rail proposed for adoption by the M. C. B. Association, which had a radius of 5/8 in. at its upper corner (in which case the point of actual contact between rail head and flange would be 5/8 in. below the track, but which section was nowhere adopted. A comparison of the standard wheel with the standard rail (see fig. 2) shows manifestly that this is too small, and that it should be measured from the point at which the corner of the rail strikes the inside of the flange to the back of the wheel; and with none of the standard rail sections does this measure less than 1⅝ in. Also in case of thicker castings, from bad workmanship in molding or casting the wheels, it may easily be placed at 1⅛ in. or 1 3/16 in. Again, some of the trunk lines desire a slightly heavier wheel than the M. C. B. standard, and their drawings and specifications call for flanges 1/8 in. larger than the M. C. B., measuring 1⅝ in. and 1⅛ in. respectively where the latter measure 1¼ in. and 1⅝ in. (see fig. 2).

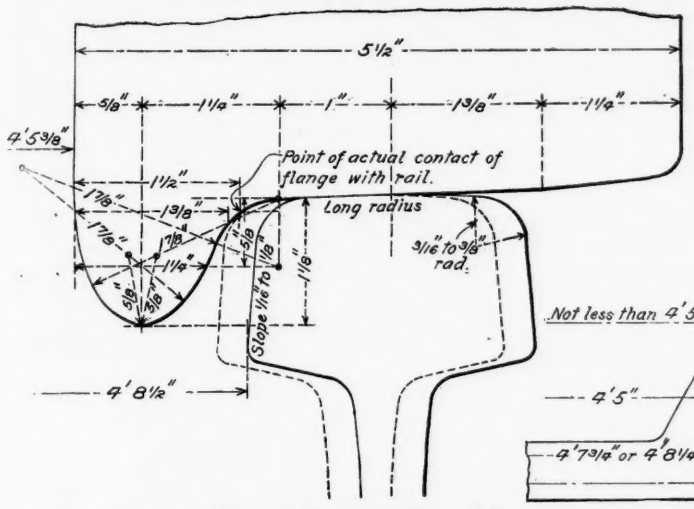


Fig. 3—M. C. B. Standard Wheel on Rail.

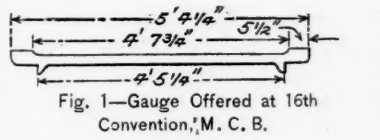


Fig. 1—Gauge Offered at 16th Convention, M. C. B.

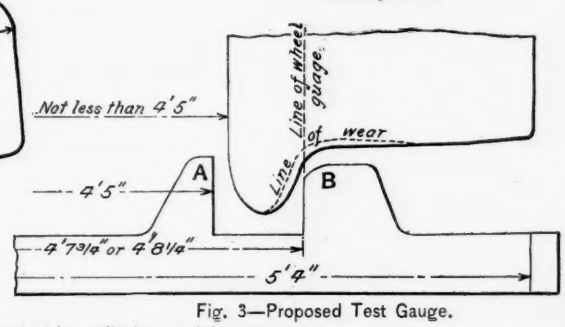


Fig. 3—Proposed Test Gauge.

NOTE: The dotted outline of rail shows points of actual contact in oscillations or tight gage.

A number of measurements taken, on nearly 800 cars in general traffic, under the direction of the writer, one to three wheels being measured under each car, showed a large majority measuring 1⅛ in. between the point where the corner of the rail struck the flange and the back of the wheel. Many (amounting to 87) exceeded that, 32 measuring 1⅝ in., and 55 1 9/16 in., between these points.

Now let us make some additions:

Standard distance between backs of wheels	4 ft. 5⅝ in.	
Thickness of flange	1⅝ in.	
	4 ft. 6¾ in.	
Distance guard rail to point of frog on 4 ft. 8½ in. track		4 ft. 6¾ in.
(With new guard rail this just clears frog.)		
Add other flange	1⅝ in.	
	4 ft. 8⅜ in.	
Gauge of track		4 ft. 8½ in

Which seems to be all right. Again:

Standard distance between backs	4 ft. 5⅝ in.	
Thicker flange occurring universally	1⅛ in.	
	4 ft. 6⅞ in.	
Distance guard rail to point of frog on 4 ft. 8½ in. track		4 ft. 6¾ in.
Strikes point of frog		⅛ in.
Add other flange	1⅛ in.	
	4 ft. 8⅜ in.	
Gauge of track		4 ft. 8½ in.
Add twice slope of face of rail, which varies 0 in. to 3/32		3/16 in.
		4 ft. 8 11/16 in.

We have a case where, under standard dimensions, the wheel will strike the point of the frog ⅛ in., and practically have to depend on the slope of the head of the rail for ability to run on the track. Again:

Maximum mounting between backs	4 ft. 5⅛ in.	
Maximum thickness of flange	1⅝ in.	
	4 ft. 7⅛ in.	
Distance guard rail to point of frog on 4 ft. 8½ in. track		4 ft. 6¾ in.
Strikes frog		⅜ in.
Add other flange	1⅝ in.	
	4 ft. 8¾ in.	
Gauge of track		4 ft. 8½ in.
Add twice slope of rail head, which varies 0 in. to 3/32 in.		3/16 in.
		4 ft. 8 11/16 in.
Wheels will not run on rails by		1/16 in. to ¼ in.

The maximum distance of mounting, 4 ft. 5⅛ in., need not be considered with the medium thickness of flange 1½ in., as the results will be between the last two. But we can readily imagine a car with 1⅝ in. flanges, which may be perfectly to gauge at all points, developing a flaw in an axle at a junction, necessitating its remounting, which perhaps being done under pressure of much business, and by a careless foreman with only the maximum of interchange (4 ft. 5¾ in. between backs) in his mind, it would be placed under a car and put into active service, undetected, so far as any rules of inspection go, and would strike every frog point, on a 4 ft. 8½ in. track, by ⅜ in. or take the wrong side of it, and would be 5/16 in. too light for the gauge of the track.

Such cases not only can occur, but do occur, and there is nothing in the recognized rules of mounting or inspecting to prevent them. It may be asserted that the clause in Art. (k) of Rule 3 for interchange—"Out of gauge"—would control that. So it should, and to a maintenance of way engineer accustomed to the accuracy of his track gauge it would. But the M. C. B. Association officially decided that it did not, and that "out of gauge' meant "less than 4 ft. 5 in. or more than 4 ft. 5¾ in. between flanges and not less than 5 ft. 4 in. over treads."

Neither does the latter dimension afford any safeguard, as the same inequalities and inaccuracies of molding, workmanship, etc., exist on that face of the wheel to a much greater degree than on the backs, but are entirely neglected as being unimportant and of no interest, and are evidently neglected to the extent of ¾ in. in the rules themselves.

Again, great wear is eagerly sought, and wheels are not thrown out of service until worn through the chill, which is ¼ in. to ⅝ in. deep. And as trucks may run for months worn ¼ in. deep on the treads of the wheels, by a reference to fig. 2 will be readily seen an additional reason for allowing for a thick flange (1⅛ in. at least) in considering the clearances.

As a matter of fact, what is the liability to these dangers that actually exists? The drawings and specifications of standard car wheels of many roads plainly name a standard wheel gauge of 4 ft. 7⅞ in. or 4 ft. 8¼ in., as the case may be, and the testimony of shopmen and car inspectors, as far as it can be readily obtained, is that this dimension is rigidly adhered to. One of the largest manufacturers of car wheels states that all wheels mounted by them, the wheel gauge of 4 ft. 8¼ in. or 4 ft. 7⅞ in., as the case may be, is the governing feature; that the other sizes of the M. C. B. standards are tested according to their recommended gauges, but that the wheel gauge is not permitted to vary 1/32 in. Without doubt all other makers would say the same thing.

It can hardly be believed that any shop foreman can be so incompetent or so careless as to mount wheels on their axles, and allow them to leave his hands, without ascertaining positively that the pair thus joined will run on his track; in fact they are, in a measure, tested the moment he puts them on his working track to be rolled away. Yet there can be no doubt that there are such men, and for such these defects in the authorized and governing code should be remedied at once.

It can readily be seen that as soon as an inflexible gauge of wheels be established the distance between backs of wheels and the thickness of flanges become complementary terms, where the one is larger the other must be smaller, that the maximum distance between flanges and maximum thickness of flanges cannot occur on the same axle, and that the variations allowed by the M. C. B. rules become simply the necessary variations due to difference in gauges of tracks, and the necessary and allowable errors of workmanship. The gauge for minimum thickness of flange becomes merely a test for safety as it should be, and a gauge for maximum thickness becomes unnecessary, as it will have been otherwise regulated, and in a much more certain manner.

Finally, a complete remedy for the evils elaborated above would be the adoption of a gauge as standard and absolute as shown in fig. 3.

This gauge would have the maximum between backs of wheels at 4 ft. 5 in. marked by the lugs "A," one at each end. It would have the "gauge line of wheels" at "B," the end of the lug being curved to fit the profile of the inside of flange and to fit down tight on the tread when in its proper position. The ends could be turned at right angles so as to meet the measurement of 5 ft. 4 in. over treads.

Very little need be said of the use of this gauge. The guard rails are taken care of by the 4 ft. 5 in. dimension. Frog points and track gauge are protected by the "gauge line of wheels" which can be fixed, without difficulty of any kind, at 4 ft. 7¾ in. or 4 ft. 8¼ in. for each gauge of track, but the larger should never be exceeded, or can be compromised at 4 ft. 8 in.; as is already done by some of the prominent car builders, especially as the actual result of present methods is a wheel gauge very rarely less than 4 ft. 8⅛ in., as tested by numerous measurements by the writer.

In mounting and testing new wheels the maximum between backs, 4 ft. 5¾ in., can be entirely neglected, as it is not even approached. The "line of wheel gauge" should be placed on the drawings of standard wheel section, and from it and the horizontal line through the tread as co-ordinate axes all dimensions be marked with as much variation as might be thought necessary or desirable by the variety of ideas as to proper sizes and proportions; so that in remounting old wheels where the tread and flange are worn too closely within the limit of the minimum gauge of thickness, the proposed gauge could be always placed approximately in the same position relative to the outlines of the wheel. Otherwise combinations could be made by fitting the worn face of flange closely to the gauge, wherein the frog points would fail of protection.

The result of the adoption of this suggestion would be the complete protection to guard rails and frogs, less wear on wheel flanges and rail heads, and a corresponding diminution in bent and broken axles and loose wheels, and also to facilitate interchange of traffic and add to the safety of transportation.

The Antofaasta & Bolivia Railroad.

It is a singular fact that, while the attention of the world has been drawn to the efforts at building the Trans-Andine Railroad between Argentine and Chili, which still remains unfinished, and the Central (Oroya) Railroad in Peru, which was only opened to trans-Andine traffic within the current year, the Antofagasta & Bolivia Railroad was quietly pushed across the Andes and has for several years been serving an extensive commerce between the lofty Bolivian plateau and the Pacific Ocean. Its present length of line is 574 miles, terminating at the Bolivian city of Oruro, which point was reached by the extension from Uyuní less than a year ago. A location has been made for a continuation of the line to La Paz, the capital of the republic, a distance of 139 miles, and surveys are in progress for a branch from Uyuní to Potosí, about 60 miles in length.

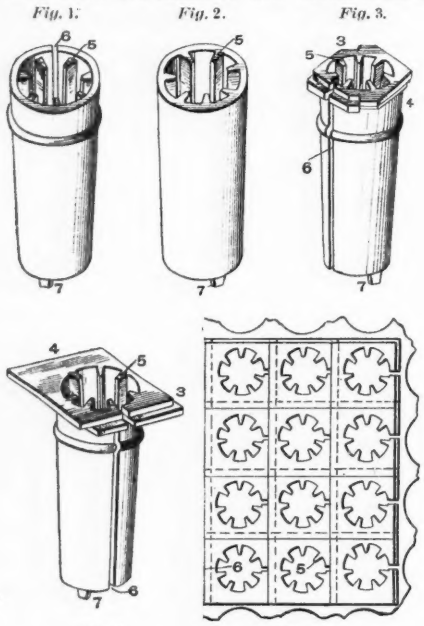
This road was built chiefly to serve the needs of mining interests along the route, those of the Huanchaca of Bolivia silver mining and reduction company being the most extensive. The works of this company are, in fact, the largest of the kind in the world, owned and operated by a single corporation, and the capital for building the Antofagasta & Bolivia Railroad was derived almost entirely from the Huanchaca of Bolivia company.

Although not the first railroad in South America to cross the Andes, being preceded by the Southern Railroad of Peru, it is at present altogether the most important of the three existing trans-Andine roads, and would seem destined soon to constitute a link in a transcontinental connection through Argentine upon the building of the proposed extension of the National Central Northern Railroad northward from Jujuy. It is cheaply constructed, as befits a pioneer enterprise in a country where railroad building is difficult and expensive, and in this respect should stand as a model of wise practice for the promoters of other pioneer lines in the Andean regions of South America; except in the matter of gage which is 30 in. The track is laid with 36 lb. steel rails, and the traffic carried on this line in 1892 amounted to 416,166 tons of freight and 21,741 passengers. Its gross income for the year was $1,235,313, or $2,152 per mile. The operating expenses amounted to $804,847, thus leaving a net income of $430,469. Of the operating expenses $33,590 went for costs of administration, $210,724 for movement of locomotives, and $222,832 for maintenance of way and structures, the remainder being distributed among repairs to rolling stock, telegraph, employees on trains and at stations, and police. The above figures are only approximate, being reduced from pesos at 30 cents. The locomotives in actual service number 46, which ran a total of 1,543,570 miles in 1892, being an average of 3,360 miles each.

End Protectors for Serve's Ribbed Boiler-Tubes.

We show a recent invention adapted to the Serve ribbed boiler-tubes. The tube, being ribbed, has to be reamed out at the end so that the tube may be expanded and made watertight; and this cutting away of the ribs at the end makes a larger opening into which coal and cinders are blown, which become lodged against or wedged between the ribs. This occurs in locomotive boilers where the fire passes directly from firebox into the tubes, when it does not occur in stationary and marine boilers. This circumstance has been an objection to using Serve tubes in locomotives. Mr. C. W. Whitney, the agent of the Serve tube in this country, has patented the device shown.

This consists of a malleable iron ferrule about 3 in.



Whitney Tube-End Protectors for Serve Tubes.

in length, cast with ribs corresponding in number and height with the ribs in the tube. This ferrule is forced into the space from which the ribs have been reamed out, and in effect carries the ribs to the firebox face of the tube-sheet, so that particles too large to pass through the tube easily cannot enter it and will fall back into the firebox.

These ribbed ferrules are shown in the accompanying illustrations, figs. 1, 2, 3 and 4. Figs. 1 and 2 are being used experimentally on the Pennsylvania Railroad to test their value and efficiency. A lug 7 insures the ribs of the protector coming in line with those of the tube. Two kinds have been made and put in service, the one shown in figs. 1, 3 and 4 with a narrow slot 6 cut throughout its length, and the other, fig. 2, without the slot, being cast solid. It is claimed that the ferrule, being driven in cold and exposed to the direct heat, will expand more than the end of the tube, and by supporting and bracing the ends of the tubes will assist in keeping them tight and thus prevent leaking. Other patterns are shown in figs. 3 and 4, where the protectors are made with a flange or cap 4, which when driven in cover the whole boiler end, and form a support and protection for the firebox ends of tubes and the boiler itself. The appearance of a boiler-end fitted with protectors like fig. 4 is shown in fig. 5. The British Admiralty is using ferrules of malleable iron of the mushroom shape on ships using more than 90 lbs. steam pressure.

Ribbed boiler tubes are coming into wider use. They have been ordered for one of the new American liners now building at Cramps to run between New York and Antwerp; they are in successful use in the White Star steamer Cufic, and have just been ordered for the White Star steamer Ionic running between London and Australia.

They are in use on 60 other French, English and American steamships. They have been fitted in the new Fall River steamer, and it is estimated that they will effect a saving of 10 per cent. in fuel, by giving so much more heating surface than is afforded by the plain tubes, and that although they cost six times as much as plain tubes they effect a very great saving in the end. They have been in use on locomotives about three years; the Paris, Lyons & Mediterranean Railroad has 200 equipped with them, and experiments by it have given 21 per cent. more evaporation with a 2½-in. ribbed tube than with a 2-in. plain tube. A few locomotives have been fitted with them in this country, but the clogging with cinders made them unpopular.

The inventor claims that these ribbed ferrules will be of great service in preventing large particles from entering plain tubes and in keeping them tight in the boiler. The consensus of opinion among railway engineers is that the swaying or vibration of tubes while the engine is in motion, and the consequent loosening of them in the tubesheet, is the principal cause of leakage. These ferrules are calculated to prevent this loosening.

Passenger Cars at the World's Fair.

We have before this mentioned the very interesting paper on the showing of passenger equipment at the World's Fair, written for the Western Railway Club by Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Railway. Certain of the most important information in Mr. Gibbs' paper he has concentrated in the table which we publish herewith.

The Forging of Eye-Bars and the Flow of Metal in Closed Dies.*

By H. V. Loss, M. E., M. Am. Soc. M. E.

(*Continued from page* 847.)

STEEL EYE-BARS.

A steel bar is at the present time upset in closed dies. In fact, such has, by the nature of the requirements of the problem, always been the case, only that the action and principle of these dies have gradually undergone an evolution. There are what might be called two general methods that at the present time represent the total output of steel eye-bars in the United States; these are:

Method No. 1.—To upset in a closed die, letting the bar thicken considerably, while the upsetting process takes place. No special attention is made or care taken to make a perfect contour, as the exact shape and thickness are afterward secured by subjecting the eye—generally after reheating—to the action of a steam hammer, or, in isolated cases, a hydraulic press, either or both of which finish the bar in dies of proper shapes.

Method No. 2.—To upset in a closed die, forcing the metal to exact contour, and allowing it to thicken just enough, that a subsequent application to a pair of slow-running planishing rolls will at one return-pass, in and back again, reduce it to the desired thickness, the purpose of the rolling being twofold, namely, of giving some extra work to the metal and also to cause smooth surfaces to insure close packing of the bars on their pins.

As a proposed third method, patented in several forms, but which, however, has never yet seen a practical application, it might be well to mention the scheme of upsetting a bar in a die with closed bottom and sides, the top being covered by a set of fast running rollers, with a reciprocating movement. The upsetting and rolling actions are both simultaneous, the purpose of the rollers being to spread the metal and keep the bar down to thickness.

I shall abstain from any criticism on this construction, as it has never been practically tried, and does not appear—to my knowledge—to have any present chance of introduction. I might, however, be pardoned for saying that I entertain suspicions as to its satisfactory effect upon the edges of the eye. In saying that steel eye-bars have always been made by upsetting, an exception must be made when referring to the method used and invented years ago by Mr. Kloman, of Pittsburgh, who originally made bars—iron at first—by the process of first rolling the body of the bar down to its proper dimensions, leaving a thicker mass of material at each end for a subsequent manipulation in hammer or press. Such a method gives, no doubt, a very perfect eye, but the difficulties in the manufacture were so many that it has been given up entirely by all makers in the United States.

In finishing the present chapter, I shall only add that while different schemes are now and then proposed, they have hitherto failed to find favor with the eye-bar manufacturers, partly due to the want of sound practical elements in their construction, and partly to the natural hesitancy, which any one would entertain, when a question arose that would imply the throwing aside of machinery, bought or built at great cost.

a.—1st Method.

In the effort to perform any certain amount of work or to accomplish any one end, the question of first cost of the appliances involved is—as a matter of course—of paramount importance. When such a reasoning is applied to the art of the manufacture of steel eye-bars, the inevitable result is a resort to the first method, viz., a partial upset and a finish by hammer or press. No doubt the inherited application of the hammer from the manufacture of iron bars has also been greatly instrumental in preserving this machine as an element in the making of steel bars. There is, nevertheless, also a third reason: the original investors in this line of manufacture wanted to adapt their plant to suit eye-bars of either iron or steel. The dies used with this method are always rough; that is, when compared to the ones as used in method No. 2. Sometimes the neck dies —see explanation under chapter "Die Construction"—

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PASSENGER TRAIN EQUIPMENT AT THE WORLD'S COLUMBIAN EXPOSITION.

Exhibitor.	Built for—	Service of car.	Seating capacity.	Size of body. Length over frame.	Size of body. Width over frame.	Truck dimensions. Kind.	Truck dimensions. Wheel base.	Truck dimensions. Dia. of wh'el	Truck dimensions. Kind of wheel.	Center to center of trucks.	Weight of car c'mpl'te.	Weight per passenger carried.
				Ft. In.	Ft. In.		Ft. In.			Ft. In.	Lbs.	Lbs.
Canadian Pacific	Canadian Pacific	Baggage	—	63 9	9 10	6-wheel	10 6	40-in.	Steel tire		59,600	
" "	" "	Second-class sleeper	64	64 4		4 "	" "	" "	" "		65,300	1,020
" "	" "	First-class coach	56	" "		4 "	" "	" "	" "		65,300	1,166
" "	" "	Dining	30	70 10		6 "	" "	" "	" "		85,000	2,833
" "	" "	Sleeper	44	77 2		6 "	" "	" "	" "		94,000	2,136
Wagner Palace Car Co		Combination baggage and buffet	15	72 0	9 8	6 "	" "	36 "	" "		90,000	6,000
" " "		Parlor	26	" "	" "	6 "	" "	" "	" "		90,000	3,461
" " "		Compartment sleeper	12	" "	" "	6 "	" "	" "	" "		100,000	8,333
" " "		Section sleeper	27	" "	" "	6 "	" "	" "	" "		100,000	3,703
" " "		Dining	30	" "	" "	6 "	" "	" "	" "		100,000	3,333
Pullman Palace Car Co		Combination baggage and buffet	23	69 0	" "	6 "	6 10	" "	" "		112,200	4,834
" " "		Dining	40	69 6	" "	6 "	" "	" "	" "		114,460	2,861
" " "		Section sleeper	27	69 10	" "	6 "	" "	" "	" "		111,900	4,144
" " "		Compartment sleeper	20	" "	" "	6 "	" "	" "	" "		112,360	5,618
" " "		Sleeper and observation	{16 sleep. 17 chairs}	69 6	" "	6 "	" "	" "	" "		104,920	6,171
" " "		Parlor	35	" "	" "	6 "	" "	" "	" "		106,200	3,034
" " "		Day coach	64	60 0	" "	6 "	" "	" "	" "		80,800	1,262
" " "		Mail	—	60 8	" "	6 "	" "	" "	" "		90,930	
Krehbiel Palace Car Co		Composite drawing room and sleeper	20	63 0	9 8	6 "	10 0	36 "	" "	43 0	64,000	3,200
Jackson & Sharp Co	C., B. & Q. Ry	Day coach	60	53 0	9 8	4 "	7 2	33 "	Chilled	39 6	53,500	891
" " "	C., M. & St. P Ry	Mail	—	60 10	10 0	6 "	9 1½	" "	"	45 2	67,000	
	Intramural Railway	Elevated railroad passenger										
Harlan & Hollingsworth	Central of New Jersey	"Club" coach	68	71 6	9 6	6 "	10 0	36 "	Steel tire	56 2	84,200	1,238
" "	South America	Officers' car	—	54 0	10 0	4 "	7 10	37 "	"	40 4	55,300	
" "	Camden & Amboy	Old passenger car "Columbian"	48	32 0	8 6	4 "	4 9	34 "	Ct. ir. sp.		18,000	375
L. S. & M. S	L. S. & M. S. Ry	Postal letter car	—	60 9	9 8	6 "	10 10	42 "	Steel tire	44 9	85,000	
" "	" "	Postal paper car	—	" "	" "	6 "	" "	42 "	"	44 5	83,000	
Baltimore & Ohio	Baltimore & Ohio Ry	Day coach	67	60 0	" "	4 "	8 0	36 "	"	46 0	70,600	1,053
" "	" "	Comb. passenger and baggage car	56	" "	" "	4 "	" "	" "	"	46 0		
N. Y. C. & H. R	N. Y. C. & H. R. R. R	Empire State express coach	84	72 0	10 2½	6 "	10 6	" "	"	55 11	95,400	1,135
" "	" "	Comb. smoking and baggage car	48	69 2½	" "	6 "	" "	" "	"	54 0	92,000	1,917
Pennsylvania R. R	Pennsylvania Ry.	Day coach	66	54 1	9 6	6 "			Chilled		81,900	1,240
Illinois Central	Illinois Central Ry	World's Fair express trains	80	35 0	8 6	4 "	5 0	" "	"	24 3	31,300	391
Old Colony	O. C. R. R	Day coach	78	60 4	9 8	4 "	8 0	38 "	Steel tire		65,700	842
Breslauer Actien-Gesellschaft Fuer Eisenbahn Wagon Bau	Royal Prussian State Railway	First and second class passenger cars	26	54 2	8 6½	6 "	24 7	" "	" "	Axles 12 8½	39,340	1,513
Van Der Zypen & Charlier	" " " "	First-class coach		33 0	9 10	4 "	6 6	33 "	" "	23 6		
Western of France	Western Railway of France	Second-class sub. with imperial	68	22 0	9 2	4 "	12 4	40 "	" "			
London & N. W	London & Northwestern	"Corridor" sleeper	12			4 "						
" "	" "	Composite day coach	34			4 "						

are planed top and bottom, but as a general thing the entire outfit and details are of a simpler and cheaper character than is necessary when the eye is brought to complete contour in the upsetting machine. However, as to the detailed form and different principles involved in the construction of the diebox, I shall defer this to the following chapter, which will contain a more exhaustive treatment on that subject.

With dies as used in machines, built to work on this method, it has been found that only very few bars—only those with thicknesses very great, as compared to their width, and only then for comparatively small eyes—will sustain the upsetting pressure without buckling sideways inside the diebox. To prevent this Mr. Wm. Webster has patented the adoption of a longitudinal ridge or groove intended to keep the bar central and to make the material flow symmetrically on both sides of this central line. Mr. Webster uses either two grooves or two ridges or a groove and a ridge; generally, however, two ridges is the construction adopted, and this form of die is at present in vogue at both the Union Bridge Co. and the Phoenix Iron Co. See fig. 3. With method No. 2, however, when the machine is fitted up with great exactness, and all dies planed, thus insuring a more central and uniform thrust of the upsetting plunger, and with the bar practically clamped vertically throughout the entire length of the diebox and over its entire width, such a precaution, as introduced by Mr. Webster, has in practice been found to be unnecessary. As a matter of course, when not necessary it is rather a disadvantage, as whatever marks are left by the ridge or groove will all have to be obliterated by the finishing machinery, be it hammer or press. If finished dies are used, plain dies are also easier machined than were they otherwise.

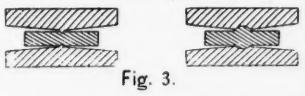


Fig. 3.

In speaking about the finishing machinery, mention has been made of a hydraulic press. It is used, but very rarely, and for several reasons: First, the pressure necessary to reduce a large eye down to proper thickness is extraordinarily great. The surface is very large and the metal is naturally dense after having been compressed in a closed die.

Secondly, the press forces the scale into the body of the bar, causing a rough exterior. A hammer will produce a better and a smoother surface, as by proper manipulation and turning most of the scale can be separated. If steam is used for the cylinders on the upsetting machine, which is often the case, the press would require a separate hydraulic plant for its operation. A comparatively small hammer has been found adequate, where a press with its dead pressure would require large dimensions to produce the same effect.

Unless the bar has been reheated it will require about 10,000 lbs. per square inch of horizontal area of eye to produce the desired effect, and even this will not always insure sharp corners. It is customary in riveting machinery to allow 18,000 to 20,000 lbs. per square inch of area of rivet head as a minimum pressure—this must not be confounded with the pressure necessary to upset a rivet, as such a resistance depends upon its diameter, length, condition of rivet hole, etc.—but it is probable that the small quantity of material contained in a rivet head will result, through a more rapid rate of radiation and conduction of its heat, in a somewhat lower final temperature. Nevertheless, accepting 10,000 lbs. as a fair estimate, an 18-in. eye would require about 3,000,000 lbs. to do the necessary work. At the Edge Moor Iron Works it was found some years ago that it was difficult to finish an 18-in. eye on a 24-in. diameter press with a water pressure of 6,000 lbs. per square inch, unless the bar had a fairly high temperature.

If the bar is reheated after coming from the upsetting machine, its resistance is naturally very much lessened, but it is of importance to note that all eye-bar manufacturers consider it a vital aim to be able to make an eye and finish it in the same heat. The steel is not improved by being returned to the furnace, and the output is seriously diminished.

As to the size of the hammer to be used, quite a divergency of opinion exists amongst the different makers. It is a well established fact that a large ram exerts a greater penetrative power than a smaller one, the energies of both being equal at the time of striking the bar. Probably this feature, resulting in an increased shattering action, is the cause of the aversion of some eye-bar makers toward a large hammer. I have heard such manufacturers say: Give us a 2 or a 2½-ton hammer; while on the other hand, the 5-ton hammer has its advocates as well. Personally, I shall admit that I do not advise a hammer at all, of any size whatever, as I do not believe any steel bar is left unhurt after being subjected to the blows of a hammer at such temperatures as those at which the bars are generally finished. The shattering action is certainly greatly nullified by careful annealing, but many bars are not carefully annealed, and again the annealing—however good—may not restore all steel to its original structure, and, speaking generally, "all steel" is more or less apt to find its way into the upsetting machine, however careful the outside inspection may be. Any engineer who has spent some years around a steel making establishment will realize and admit this statement.

Coming back to the question of the hammer, I am certainly in favor of a less injurious manner in which to finish the bar, and the second method permits this to be done by a pair of slow-running planishing rolls. Such a process is, however, out of the question with

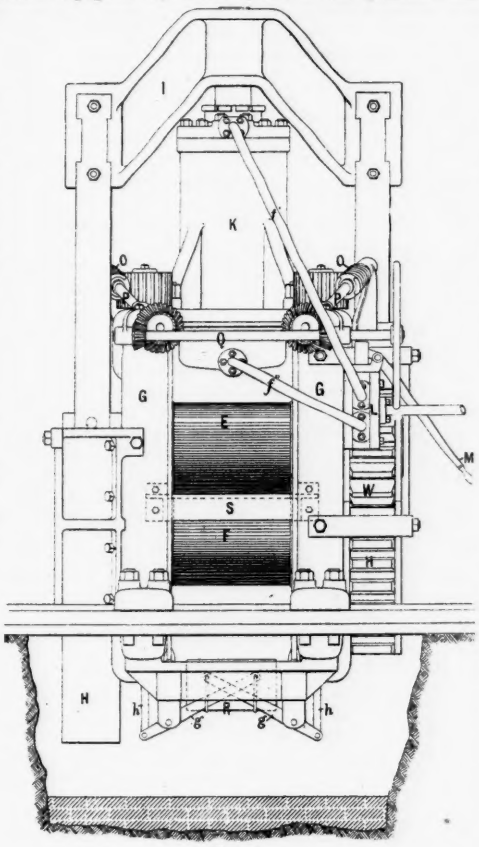


Fig. 4.

bars manufactured by this first method, as the use of rolls presupposes the completion of the contour of the eye in the upsetting machine.

b.—Second Method.

If the objections raised to the use of a hammer and press are considered vital, and if an additional first cost can be tolerated, in view of being followed by an increased output, the second method will be found to fulfill all the requirements. An upsetting plant of this character is certainly very costly, but when in good working order the larger output will justify the additional expense, as long as the market requires the product. The machines are in this case capable of the exertion of intense pressures, this being necessary to form satisfactory edges and to force the metal into the most remote corners of the die. The driving medium is therefore invariably water under pressures of from 3 to 4,000 lbs. per square inch. Old parts are of great strength and durability, made of the best of materials and the whole fitted up like a machine tool. The dies are planed throughout and made exceedingly strong. Such machines are at the present time running with the capacity for making 30-in. diameter eyes, which would represent about a 12 to 13 in. wide bar. The largest dimensions, as hitherto made for the market, however, have been 24 ins. in diameter on a 10×3-in. bar. Nevertheless, machines have been planned for 36-in. eye on 16×4-in. bar, but whether such an eye-bar will ever be called for is a question to be decided by the bridge engineers and outside the scope of this paper. To make bars that can be relied upon as being homogeneous in such large cross-sections, is also a problem for the steel maker.

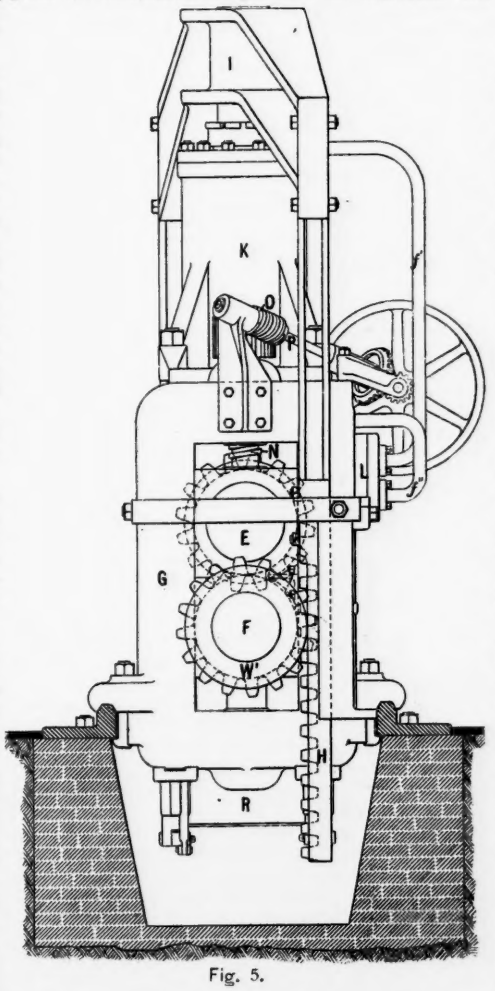


Fig. 5.

A favorable reply to both of these queries—in connection with the final disappearance of iron eye-bars—would certainly stimulate the use of this method. At this writing, however, the second method is used by only two makers, viz., the Edge Moor Bridge Works and the Pencoyd Iron Works, the remaining manufacturers of steel eye-bars all adhering to the process, represented by method No. 1, as being the cheaper first outlay.

As previously mentioned, the bars are finished in a pair of slow-running planishing rolls. In passing through these rolls the eye is naturally elongated, and the dies are therefore correspondingly shorter in the upsetting machine to compensate for this stretch, which varies from about ½ in. on an 8-in. eye to about 1¼ in. on a diameter of 18 in. A bar, as manufactured by this method, is allowed to thicken about 3-16 in., which can readily be reduced by one return-pass. Figs. 4 and 5 show the finishing machine, as used by the Edge Moor Bridge Works. It is driven by a hydraulic cylinder, located on the top of a pair of housings. The piston is connected through racks, with a pinion on the end of each roll, thus causing a partial revolution, of sufficient magnitude, however, to reduce the full length of the maximum eye and its neck. The rolls are made of cast iron, chilled to prevent cracking.

As to the form of dies used with this method, they will be treated in the next chapter, entitled: "Die Construction," containing a full treatise on the different principles involved in this part of the machinery.

(TO BE CONTINUED)

Ships and Shipping.

New and Larger Docks.—Philadelphia is seeking to have her harbor lines so located as to provide for piers 600 ft. in length along the water front. The Harbor Line Board met recently and gave a hearing to riparian owners to get suggestions concerning the proposed location of the line. The sentiment generally expressed was in favor of 600-ft. piers in the northern and southern sections of the city. Such wharves would accommodate the largest ships, and would give to the railroads and the Cramp shipbuilding firm some relief. The Pennsylvania and Reading Railroad companies are reported as having recently acquired large water front territory, the former having purchased several blocks of wharves and the latter nine piers of great value, at a cost of nearly $1,750,000. On these sites they will build the most complete and finest steamship piers in the United States, which will run out into the Delaware to the limit of the new Port Warden's line, or nearly 300 ft. beyond the present pier lines.

New Battle Ship.—Secretary Herbert has decided to recommend to Congress the construction of another battle ship and a half dozen torpedo boats. Four of the torpedo boats are recommended in place of a second dynamite cruiser authorized by Congress to be constructed at a cost of $450,000, if the Vesuvius proved to be a success, and two in place of a submarine boat for which $200,000 has been appropriated. France now has 248 torpedo boats, England 208, Italy 185, Germany 180, Russia 168, China 69, Austria 65, Holland 63, Greece 51, United States 3. The programme outlined by the Navy Department provides for one battle ship a year, until 12 shall have been built. Last year none was ordered because of the state of the Treasury.

The Columbia.—The official report of the Trial Board of the cruiser Columbia gives the official speed as 22.80 knots, under forced draft, with an average air pressure of nine-tenths of an inch, the same having been corrected for tidal flow, etc. The Board finds the vessel possessed of qualities of steadiness, seaworthiness and ready obedience to the helm in a marked degree, and sufficiently strong to carry the equipment, coal, stores and machinery indicated in the specifications. With the exception of some slight drawbacks, the performance of the engines, boilers, and dependencies was excellent, reflecting great credit both on the designer and the builders. Only the best materials and most thorough workmanship, says the Board, could have produced engines and boilers of such notable performance.

The Board invites attention to the unfortunate location of the hawse pipes, and recommends that the pipes be placed higher up and that the change be made before

the ship is put in service. The premium of $350,000 is said to be the largest ever earned in a naval trial.

The Olympia.—The trial trip of the Olympia was not finished on the 27th inst. on account of a heavy fog that set in and shut out from view the stake boat and beacons. The reports of the run made show the Olympia one of the fleetest of our war vessels, the first 30 miles of the course having been made at an average speed of 22.25 knots an hour. The patent log registered for 13 miles a rate of 25.59 [miles presumably] an hour, or 22.26 knots.

Railroad Matters in Chicago.

Freight Traffic.—Despite complaints of slack business, last week's outward bound traffic was larger than for the week immediately preceding. There was, however, no material change in the class of property moved, the great bulk being heavy goods wanted by the interior retail trade; stoves, furnaces and coal, the consumption of which is stimulated by increased cold weather. Hard coal shippers stated that orders from every point as far west as Denver, Col., were liberal in number and urged immediate shipments. The officers of leading lines complain that they have altogether too many idle cars to admit of good earnings from their tonnage traffic; and while the outlook for an average movement of outward freight the remainder of the year is fairly assuring, there are few reasons for supposing that an increased business will develop. The inbound grain traffic was also better than anticipated. The deliveries here by the 11 Western lines aggregated 4,237,000 bushels, against 4,862,000 bushels the preceding week and 2,827,000 the week ending Nov. 26, 1892. The liberal increase the past week over the corresponding period last year was the more surprising because of the unsatisfactory prices which interior railroad agents and shippers said would be a serious bar to free deliveries by farmers. A comparison of the movement at other leading Western markets also shows an excess over the corresponding time last year in the volume of the same class of business. There was also an increase in flour and miscellaneous produce at Chicago of 2,359 tons. The aggregate of livestock brought in, while larger than the week immediately preceding, showed little change from the week ending Nov. 26, 1892, a shrinkage in the arrivals of hogs being compensated by a heavy gain in the number of carloads of other stock. It is also understood that the average rates for such property are better than last year. This is in part due to a more uniform system of charging for actual weight than by the carload, as formerly. The recent decision of Judge Horton, which allows the railroads to collect demurrage where shippers fail to unload cars within 48 hours after notice of their arrival is received with great satisfaction by the leading lines.

The following shows the amount of flour and grain deliveried at Chicago by each of the railroads mentioned the week ending Nov. 25, and the corresponding week in 1892:

	1893.		1892.	
	Flour.	Grain.	Flour.	Grain.
	Bbls.	Bush.	Bbls.	Bush.
C. & N. W.	22,394	729,000	38,108	664,000
Ill. Cent.	3,300	641,000	150	296,000
C., R. I. & P.	11,650	341,000	4,200	271,000
C., B. & Q.	19,339	829,000	24,706	830,000
C. & Alton	10,650	374,000	1,200	108,000
C. & E. Ill.	450	80,000	.....	73,000
C., M. & St. P.	16,500	562,000	18,275	285,000
Wabash	900	169,000	1,500	53,000
C. & G. W.	25,934	161,000	31,790	141,000
A., T. & S. Fe	410	352,600	300	101,000
L., N. A. & C.	.....	5,000	189	2,000
Totals	111,527	4,237,000	120,418	2,827,000

Passenger Traffic.—The inward and outward passenger traffic continues light. There is nothing substantial on which to base predictions of an early improvement business in nearly all lines being quiet. There is little to stimulate travel in any direction, and the situation is also aggravated to some extent by the demands from the interior for the continuance of a class of passenger trains put on when the World's Fair travel demanded increased facilities, but which are now non-paying. General Manager St. John, of the Chicago, Rock Island & Pacific, in speaking of such service said: "We took off two trains which were put on during the World's Fair because they were not earning expenses after the rush of travel to the Fair ceased, but the complaints from a few people along the line were so persistent that we felt compelled to reinstate them despite the fact that they were run at a loss." The general manager of another leading line said, "Placing extra trains on our line during the World's Fair spoiled a good many people who were previously well satisfied with the service. Now, however, they think we must run trains for their particular benefit regardless of the loss it entails on the company. For the present we shall continue some of the non-paying service, but I cannot say how long. If we find the losses too severe, and the railroad commission insists on the trains, we prefer to contest the legality of the demand in the courts. It is a matter where all the roads can unite in the expense of a single test case and the decision will establish a precedent which will govern all similar cases." The railroads have no fears as to the results, as they will apply to the Federal courts for relief and they have never yet rendered a decision which required the roads to perform a service for nothing; and the operating of passenger trains at a loss when the railroads are already rendering reasonable transportation service would amount to that. The great majority of the complaints referred to come from Iowa and the newer states.

Heretofore the Wisconsin Central and the Chicago & Great Western have been designated by the other line in the western group as "chronic rate disturbers"; hence their admission into the emigrant pooling arrangement, which is now one of the strongest compacts ever made between the western railroads, is regarded with satisfaction. It is further stated that the traffic managers of both the Central and Great Western have signified a determination to harmonize with the other lines for the maintenance of rates on other classes of business, including both freight and passengers.

The Pass Question.—A special meeting of the general managers has been called for Dec. 5 to consider the question of free passenger transportation for the coming year. There is said to be a strong inclination to materially curtail the present system of granting passes, and especially to employes of different lines. It is claimed that the less important roads have greatly abused the privileges heretofore granted them by the leading lines by an almost indiscriminate practice of requesting passes for about every class of employes and their friends. Other very important reforms are also contemplated, including the hauling of special cars long distances for the officers of every little stub road.

Track Elevation.—Little has recently been heard in regard to the enforcement of the ordinance requesting the railroads to elevate their tracks within the city, and it is said that the majority of the committee of aldermen chosen by the council to look after its enforcement have arrived at the conclusion that the project is impracticable. First, because any system which could be devised would destroy the approaches to every bridge on the Chicago River; second, it would greatly cripple many manufacturing industries and ruin others that receive supplies and distribute their finished products by private tracks connecting their establishments with the railroads, and be equally injurious to the coal and lumber interests. It would, in fact, drive the latter business from the city, and enhance the expense of handling the former to an extent to make this one of the dearest coal markets in the country; third, it would necessitate the reconstruction of the grain elevators at an enormous cost and drive the track trade in grain and other products from the city; fourth, the expense of track elevation as contemplated by the ordinance would be beyond the means even of the richest railroad corporation centering here; hence the roads would be compelled for self protection to establish both freight and passenger departments outside of the city. The injurious effect to Chicago by the latter could scarcely be computed, and as the public begin to appreciate the injury which track elevation would entail on the material interest of the city the demand for it will cease, except for the class of aldermen who wish to make themselves solid with the uninfluential constituency they represent. In fact the ordinance for track elevation was brought forward and passed on the eve of an election when about every member was desirous of a re-election. In recent interviews with a number of general managers of leading roads, they invariably stated that they did not intend to take any action looking to a system of track elevation as proposed by the O'Neil ordinance, or that of any other member of the City Council; that in case mandatory proceedings were commenced by the city the railroad companies would apply to the courts for relief, and if denied by the latter their only couse would be as above stated, namely, establish a system of central depots outside the city and compel their patrons to come to them. These facts were clearly pointed out to a delegation of aldermen and their constituents by Mayor Harrison only a few days before his assassination. And have also been forcibly presented to others by a prominent member of the council committee who has been investigating the matter and consulting with engineers with a view to preparing a report.

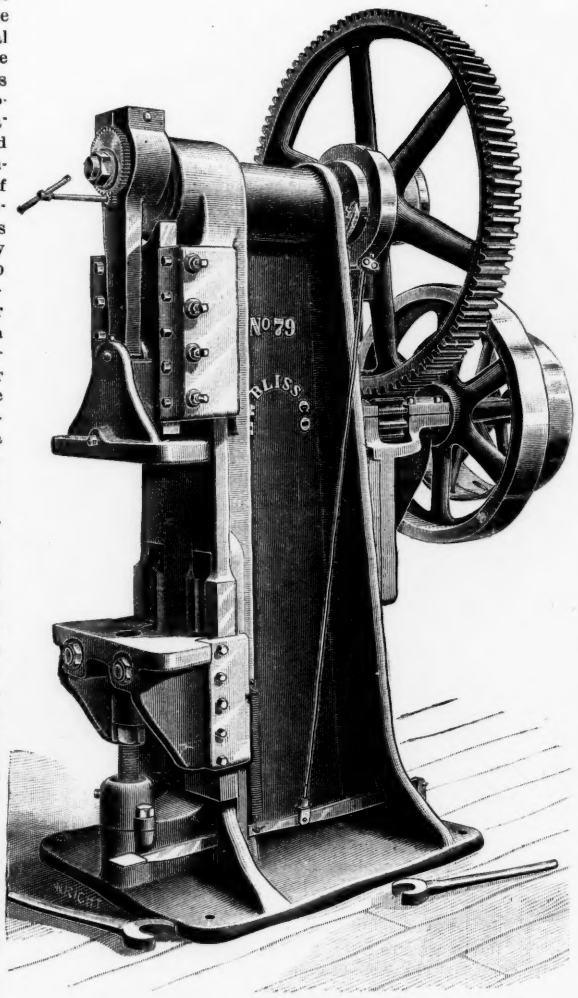
Railroad Repairs.—It was thought, and in fact hoped in some quarters that after the close of the World's Fair managers would devote some attention to the physical condition of their tracks and rolling stock, and that the necessity for repairs would stimulate a better demand for track and equipment supplies. This expectation was increased by the heavy reduction made in prices for steel rails at the opening of the month. It appears, however, that such anticipations were ill founded, as no appreciable improvement has developed. On the reverse, interviews failed to discover any inclination to purchase materials except in a very moderate way. When questioned as to what they are doing in that line the presidents and managers reply that they made liberal outlay on their tracks and rolling stock at the close of last year and the opening months of the current one, and the work done was of such substantial character that they have less than the average amount on hand and do not look for an early increase. They further state that they see nothing in the current or prospective situation to warrant the conclusion that prices are likely to advance, hence they are disposed to withhold orders until the goods are wanted. One party remarked that while wise economy if not absolute necessity would demand a moderate amount of track renewals next year, he was well satisfied that rails would be bought as cheaply then as now. In support of this opinion he cited the low cost of production at present figures for raw materials, as well as the abnormally cheap figures for nearly every leading article of merchandise and farm products; also that the public was rapidly becoming educated to reduced values, and further that in view of the present enormous producing capacity of the country there was no reason to fear an advance in prices on the basis of an insufficiency of supplies to the demand and that any enhancement based on purely speculative sentiment would be of short duration. Other managers expressed similar opinions regarding future prices, and said that they would take their time and give orders when their mechanics and engineers advised them as to what was wanted. It is generally understood however that 80 lbs. per yard will be the popular rail and where lighter weights are taken up they will, if suited for further use, be put down on sidings and spurs where the service is less severe.

At a recent meeting of the General Managers' Association the question of switching in the Chicago yards was definitely settled by placing the entire business under the control of a single head. This change will, it is claimed, not only relieve the officials of the roads of a large amount of labor and vexation, but save an aggregate of at least $75,000 in the switching expenses here. It is also proposed to adopt a similar system at other leading cities where Chicago roads connect.

CHICAGO, Nov. 27.

A New Reducing Press.

The illustration shows a long stroke power press made by E. W. Bliss & Co., of Brooklyn, N. Y. It is designed for redrawing, shaping and trimming deep sheet metal articles and for broaching castings or forgings. The table has a screw adjustment, clearly shown in the cut, which admits of the use of dies of varying height, and



Bliss Reducing Press.

the eccentric device may be minutely adjusted for fine work. An automatic clutch, controlled by the foot, stops the slide at the top of the stroke, unless continuous strokes are wanted, which are caused by holding the treadle down. For broaching, back gearing of high ratio is provided to give a very slow motion, when the friction clutch is attached to the driving shaft instead of the crank shaft. The press weighs 8,200 lbs., with a maximum distance of 15½ in. between the slide and bed; a maximum stroke of 8 in., and a 10 in. adjustment of the table. The ratio of gearing is 1 to 7½, and it may make 40 strokes per minute.

Foreign Railroad Notes.

The Russian Government now publishes yearly a great volume of statistics of the movement of freight on the railroads and water courses of the country. Unfortunately, only tonnage, and not ton mileage, is given, so that we have really little idea of the amount of traffic, though, in the absence of anything to indicate a change in the average haul, we may compare one year with another. The last issue covers the business of 1891, when 35,226,000 tons were carried on the railroads, which differs very little from the tonnage of the three previous years. Of the whole, no less than 21.9 per cent. was grain and flour; 14.8, coal; 13.5, wood and timber; 6.2, petroleum and its products, and 3.2 per cent., salt; these articles thus making nearly 60 per cent. of the whole. The grain and flour carried amounted to more than 250,000,000 bushels. Of the total freight shipped 28½ per cent. went to seaports or border stations in 1891, which was the famine year, when exports for breadstuffs were prohibited altogether for several months; but in 1890 the part going to ports was only 29½ per cent., and in 1889, 30½. Nearly twice as much is carried to the Black Sea and the Sea of Azof (connecting with the Black) as to the Baltic. More freight comes into Russia at the border stations (chiefly from Prussia) than goes out of it.

The freight moved on interior watercourses, excluding timber rafted, was 11,124,000 tons in 1891, or nearly one-third of the railroad freight. This water tonnage was a trifle greater than in the two previous years, and eight per cent. more than in 1888. The timber rafted decreased from 9,540,000 tons in 1889 to 9,000,000 in 1890, and 7,524,000 in 1891. The grain shipments by water were about 75,000,000 bushels. About two-thirds of all the water freight was carried on the Volga, or the canal and other waters which connect it with St. Petersburg.

The Trans-Caucasus Railroad, as the line is called which connects the Caspian with the Black Sea, has the Russian oil region at its Caspian terminus, and petroleum forms a large part of its traffic. The road has very steep grades and a single track, and the petroleum production is increasing so fast that there is talk of laying a pipe line to carry it to the Black Sea; but the railroad authorities advocate laying a second track instead. The oil men complain of overproduction, the output of illuminating oil from this region having been about 340 million gallons in 1890, 371 in 1891 and 392 in 1892.

Russia consumed only about one-third of last year's production, and the remainder had to meet American competition. Outside of Russia India is the principal consumer of Russian petroleum, taking about 73,000,000 gallons in 1892, while England took 33 millions, Austria 31, and other European countries 54 millions.

In the year 1892, 44,181,367 persons departed from and 43,513,168 arrived at the eleven Paris railroad stations. Nearly 18 millions departed from one station. The whole number was 10 per cent. more than in 1891.

Prussia has probably a force of railroad employees as thoroughly disciplined and on the whole as trustworthy as any in the world; yet recently on the Berlin & Stettin Railroad as many as 20 conductors have been engaged in "knocking down," which they did by selling tickets which they had taken up. A number of them have been arrested.

Rails 40 ft. long, weighing 84 lbs. per yard, have been ordered for parts of the Hungarian State railroads over which express trains run.

At several of the large stations of the Bavarian railroads electric light plants have been established recently by the management, which reports not only a much improved illumination, especially in the case of lights in the open air, but an important economy. The cost at four stations is given as follows:

	Bamberg.	Nuremberg.	Ratisbon.	Würzburg.
Gas.....	$24,053	$39,709	$31,362	$27,830
Electricity....	13,553	18,553	16,542	20,648

This shows a saving 44, 40, 54 and 26 per cent. at the four stations, respectively.

The Imperial Royal General Inspection of the Austrian railroads has ordered that hereafter on time-tables those stations where nothing is to be had except drinks (wine, beer, coffee, tea, etc.) and cold victuals shall be designated by the figure of a cup. Those stations where warm dishes are obtainable at least at meal times, must be designated by a crossed knife and fork. Trains in which a dinner on a tray will be provided passengers who give the guards orders therefor, and those which have dining cars attached (one or two in the Empire), must have that fact noted on the time-table.

The famous Swiss locomotive works at Winterthur has been enlarged this year, and now employs nearly 900 men. In 1884-85 it produced $292,000 worth of work; in 1891-92, $873,000 worth; in its fiscal year recently ended, $954,000 worth. The output was 69 locomotives last year against 65 the year before, and it has orders on hand for 65 now.

The Monte Generoso Mountain Railroad on the Italian side of the Alps, but in Swiss territory, from whose upper end is had a glorious view of the Italian Lakes, the great plain of Lombardy and the highest Alps illuminated by an Italian sun, was sold at auction Oct. 4, having been open but two seasons. It had cost about $400,000 and brought but $73,400. The purchaser, Dr. Carlo Pasta, owns a large hotel on the side of the mountain and has also bought the hotel and restaurant which the railroad company built on the summit. This mountain railroad is within 40 miles of the great city of Milan and but a few miles from the St. Gothard railroad route from that city over the Alps, perhaps the most picturesque railroad route in the world; and it is within a few miles of the three beautiful lakes, Maggiore, Lugano and Como, which are great resorts of tourists in the spring and early summer; yet it seems the number of visitors has been insufficient to support the railroad.

The company which works the chief railroads in European Turkey, having a system of 785 miles in all, reports the number of passengers on its lines in 1892 to have been 3,420,078. This seems to indicate a respectable traffic, until we learn that 2,943,493 of these passengers were on the few miles of a city railroad in Constantinople, leaving but 476,585 for the great mass of its lines, and illustrating again the worthlessness of the number of passengers and tons of freight as a measure of traffic. It may be noted that the system carried 3,630 dogs and only 3,189 cattle during the year. About three-eighths of all the freight was grain carried to sea ports, amounting to about 8,200,000 bushels. The gross earnings of the system were at the rate of $3,253 per mile; the net, $1,756.

The Department of Public Works of Spain permits the use on passenger trains of the Westinghouse, the Smith-Hardy and the Carpenter brakes. A French brake used on one of the great French systems is not approved, and another has not yet been tested.

Transmission of Power by Compressed Air in Chicago.

On Feb. 29, 1892, the Chicago City Council passed an ordinance granting to John P. Bacon, as promoter of the Chicago Power Supply & Smoke Abating Co., permission to lay pipe lines in the streets of the city; the pipes were to convey compressed air from central stations to such establishments as would use it for power purposes. When the ordinance was introduced it met with strong opposition from the city press and citizens, objections being made not only to tearing up the streets during the World's Fair, as it was expected the company intended to do, but also to what was termed the dangerous feature of having such pipes under the streets. To show that it was dangerous to have such pipes under the streets, reference was made to New York City, where the streets are sometimes torn up by the bursting of steam pipes which are laid under them. However, the ordinance was granted to the Chicago company, and in it was the condition that three miles of pipe line should be laid within two years. Only three months of the time remains now, and nothing has been done toward laying the pipes. Interest in the case is revived at this time by the fact that Mr. Bacon has asked the Department of Public Works for a permit to begin the work.

Especially interesting in this connection will be some of the remarks of Professor Goodman, of the Yorkshire College, in a lecture delivered recently to the Leeds Association of Engineers. He said that the transmission of power by compressed air had not had due consideration from engineers, but that where it had been made use of by competent engineers, very satisfactory results had been obtained. Much of the loss in transmitting power in this way is due to the fall in temperature of the compressed air between the compressor and the motor, but the greater part of this loss may be overcome by cooling the air at the compressor and reheating it at the motor. The jet condenser is better adapted to produce this cooling than the surface condenser. Professor Goodman said that there was but little loss due to friction in the mains, and considerable loss due to excessive clearance in the engine. In comparing the transmission of power by electricity, water and air, it was shown that the cost by the first method was six times as great as by air, and that the danger to property by leakage from the mains, was reduced to a minimum by the use of air.

TECHNICAL.

Manufacturing and Business.

The Riehle Bros. Testing Machine Co. is furnishing two testing departments with an outfit of testing machines. One is the physical testing laboratory to be established by Charles F. McKenna, at 221 Pearl street, New York, and the other is a physical testing bureau established by the Department of Public Works, Peoria, Ill.

The new roll turning shop of the Leechburg Foundry & Machine Co., of Pittsburgh, has been completed and equipped with roll turning lathes of modern design and large enough to turn the largest rolls used.

The shops of Pedrick & Ayer, Philadelphia, are now in operation, running 10¼ hours a day, with about half the regular force at work. Orders for railroad tools are coming in fast enough to warrant running continuously. The firm is now under the management of James M. Hibbs, as Assignee, pending the formation of a new company.

The following companies have been incorporated in Illinois: Northwestern Supply & Construction Co., of Chicago; capital stock, $500,000; incorporators, Colin C H. Fyffe, Henry R. Pebbles and Howard D. Headley; Whitacre Airbrake Co., East St. Louis; capital stock, $500,000; incorporators, William C. Whitacre, John F. Baumgarner, Shepard Knapp.

The Rand Drill Co., of New York, had the order for the compressors for furnishing air at 3,000 lbs. pressure for the dynamite gun on the steamer "Nictheroy," now owned by the Brazilian Government and formerly known as the Morgan Line steamship "El Cid."

The sales of the Gold Car Heating Company in the United States alone to Nov. 1 amounted to over $1,100,000. The company has also had considerable success in introducing its improved car heating methods in England and other European countries. Its storage system is now in use on many of the largest foreign railroad lines. The company received the one award at the World's Columbian Exposition for a storage car heating system. The Gold Car Heating Company has always been managed on a very conservative basis by Mr. Edward E. Gold, who has been President since its organization, and its business methods have always been commendable. Its financial success is not only gratifying to the friends of the company, but in its way is an important indication of the great progress made in steam heating in this country.

The directors of the Michigan Peninsular Car Co. have decided to defer payment on the preferred stock due Dec. 1.

The Washburn Car Wheel Works, at Worcester, Mass., will soon resume active operations.

Henry William Byers, of New Castle, Pa., Engineer of Maintenance of Way on the Erie & Ashtabula Division of the Pennsylvania, has patented an automatic rail frog and an apparatus for unloading and distributing rails.

Mr. John C. Paul, the Receiver of the American Steel Wheel Company, announces that the property of the company, including the tools, machinery, goodwill and all the assets of the company, will be sold at Garwood, N. J., where the shops are located, on Dec. 13, under an order of the New Jersey Court of Chancery.

Iron and Steel.

The Bessemer plant of the Maryland Steel Co., at Sparrow's Point, Md., has resumed operation on an order for rails for the Pennsylvania Railroad. Next week the mills will roll rails for the New York, New Haven & Hartford. After completing these an order for steel billets will be filled. This will finish up all work in hand, and unless new orders are received the mill will be shut down for an indefinite period.

The Morris & Bailey Steel Company, of Pittsburgh, Pa., will soon take possession of its new plant at Wilson's station, Pa., on the Pittsburgh, Virginia & Charleston.

The new Bessemer plant of the Ohio Steel Company, at Youngstown, O., is nearly finished and some of the machinery is being put in position.

The Hamilton Iron & Steel Co., recently organized, with office in Hamilton, Ont., has elected the following officers: Wm. Foster, Jr., President, New York; John H. Tildon, Vice-President, Hamilton, Ont.; J. J. Morehouse, Treasurer and General Manager, New York; and H. M. Curtis, Secretary, New York.

New Stations and Shops.

H. K. Porter & Co., of Pittsburgh, will shortly commence the erection of a new brick machine shop 72 × 135 ft. and two stories high. A new office building to cost $5,000 will also be built by this firm.

The State Street Railroad Co. at New Haven, Conn., has placed the contract for the roof on its new power-house with the Berlin Iron Bridge Co. The building will be 84 ft. × 250 ft., the roof trusses being of iron, covered with slate.

The Southern Pacific will build a new cotton shed at New Orleans, 120 ft. × 350 ft. The building will be entirely of iron, the sides being made with the Wilson patent rolling shutters. The ironwork is under contract with the Berlin Iron Bridge Co.

The contract for building six stations for the Portland & Rumford Falls road, between Mechanic Falls and Auburn, Me., has been awarded to Murch & Arnold, of Auburn.

The Lake Shore & Michigan Southern is understood to have leased the Erie Car Works. The plant was purchased by the First National Bank of Erie, Pa., a large creditor, at the sheriff's sale, and has been idle nearly a year. The railroad company will use the buildings for repair shops, and, it is said, will have them in operation within two weeks, employing about 200 men.

Time Ball Service in Chicago.

A time ball service has been installed at Chicago on the top of the Masonic Temple, by which sailing-masters on the lake and people on land within a radius of 10 miles can, with the aid of a glass, correct their time pieces every day at noon. Precisely at noon, Central time 90th meridian), the ball, 4½ ft. in diameter, is dropped from the top of a hollow steel mast, 30 ft. in height above the dome of the building and 332 ft. above the ground. The outfit was designed and installed by Professor Gardner, of the United States Naval Observatory, the originator of the Naval Observatory Time Service.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The decision of the Interstate Commerce Commission in the case of Duncan against the Atchison, Topeka & Santa Fe, the Southern Pacific and the Louisville & Nashville, was reported in the *Railroad Gazette* of Nov. 24. The official copy of the report, since received, shows that one point of considerable interest was omitted, and we therefore reprint the second paragraph of the syllabus, which is as follows:

Where a contract is made with a shipper by a carrier, member of a through line, for shipment of goods over the line at a less than the published lawful rate charged shippers in general, it is not a violation of the Act to Regulate Commerce for the delivering carrier to exact payment of the full lawful rate before delivery. Where, however, the shipper did not enter into the contract willfully for the purpose of securing a rate which he knew, or by the exercise of reasonable diligence might have known, to be illegal, but was an innocent party to it and made the shipment on the faith of the rate named, the courts seem inclined to hold (and it is a matter for their determination) that justice to the shipper requires that the goods be delivered on payment by him of the amount specified in the contract.

References to decisions by the Supreme Court of Alabama in 1891, and by other courts, are given. Commissioner Clements takes occasion in this opinion to deliver a lecture on the bulldozing customs of the railroads which compel consignees to wait months and years for the settlement of small overcharges. Excessive freight bills, where the shipment has been carried over two or more roads, are constantly being complained of before the Commission. The report says:

It is difficult to understand why mistakes in through rates should be of such frequent occurrence and why, by the exercise of ordinary diligence, they may not be avoided. If tariffs, classifications and rules are so uncertain or complex and confusing, that even a railroad agent, whose special duty is to know them accurately, cannot advise shippers with certainty what the rates are, then either a simpler, more certain and less perplexing system should be adopted, or else agents of a higher order of intelligence should be employed more.

In discussing the rightfulness of a demand by the railroad, that shippers shall release it from liability above $5 per 100 lbs, on household goods, this report omits one point of considerable interest, and that is the proper course in case a shipper refuses to execute the release. It is held that the reasonableness of the limit in the release must be determined, in case of loss of goods, by the courts. This may be right, but a shipper desires to know the equities of the matter beforehand; rather than wait to sue for damages he may prefer to pay the higher rate and ship the goods unreleased, and the Commission might well have expressed an opinion on the reasonableness of charging fifty per cent. more for unreleased shipments, as is generally charged where the released rate is first-class; and of making such a condition as that household goods lost or damaged shall be paid for by weight. In point of fact both of these conditions are very unreasonable, and the inexperience of the average agent or freight clerk in figuring rates to distant points comes in to add to the perplexity of the unsophisticated shipper. In a recent case that came to our notice the agent stoutly asseverated his inability to give any rate whatever on an unreleased shipment, thus giving the shipper no alternative but to practically run his own risk of damage. While Commissioner Clements has set forth some good common sense in this decision, the practical remedy for these petty annoyances to shippers is probably as far off as ever. One of his remedies is to appoint smarter agents, but we doubt its efficacy. Agents at large towns and clerks in general offices make these petty blunders, as well as the untrained agents at country stations. As fast as the agents are improved the exigencies of competition introduce additional complications in the tariff. The only way in which a road can simplify its rates and the conditions on which prices are computed, is to restrict them to territory near home, but in doing this it may lose business.

The essential point in the question of the use of electricity as a motive power for boats on the Erie Canal appears to have been missed in the numerous accounts and discussions of the recent experiment at Rochester that have appeared. That point is the possible or probable economy, and upon that everything turns. It is a matter of course that a screw to propel a canal boat can be turned by electricity just as well as by direct steam. It is the simplest thing in the world to lift the engine and boiler out of a canal boat and put in an electric motor, and to take the current from a trolley wire stretched overhead. So far the much talked of experiment was entirely superfluous. Everybody who knew anything about the practical applications of electricity to motors knew that what was done there, could be done; it was a matter of ordinary mechanical skill. No doubt the advertising element of the experiment was its most important part, and it was a legitimate step in the promotion of what we believe to be an honest enterprise. We understand that the men who are working up this project are honorable and sensible, and we presume that they will not take good cash for their stock without giving what they think is an equivalent. But the vital point, the commercial economy of the use of this power, is untouched. Governor Flower is reported to have said that the capacity of the canal can be multiplied by more than four at no increased cost to the state, if electric propulsion is used; and in another sentence he says that he understands that by the use of electricity the cost of transportation on the canals can be reduced three-quarters. Now, that is precisely the point, and we venture to say that His Excellency did not know much more about the relative cost of working the traffic with electricity, steam and mules than anybody else. It is quite possible, and indeed we think it probable, that it will be cheaper to turn the screws of canal boats by independent steam engines than by electric motors; and yet it is possible that electricity may be taken from the great plant at Niagara and other great water powers, transmitted long distances and delivered to each boat, at a less cost than the same power can be generated for on board. Speed is not in the question at all; a higher speed can be made with steam power as well as with electricity. This is elementary to engineers, but Governor Flower and some writers for the press do not seem to have grasped the fact. The prism of the canal is what limits the speed; not the motive power. Again, how is the electric boat going to get up and down the Hudson? Of course it must be towed just like an ignominious old mule boat.

A case of unusual interest and importance was settled last Tuesday in the Court of Appeals of the State of New York. This was the suit of O'Brien against the city of New York for compensation for extra work on the New York Aqueduct. It had been decided against him in the lower courts and the decision in those courts is confirmed by the Court of Appeals, thus settling the matter. The amount sued for was $732,313. This, however, was only a test case, for had it been won by the plaintiff, further claims amounting to somewhere between five millions and eight millions of dollars would have been brought against the city. Besides the amount of money involved the decision is of great importance to engineers and contractors as involving a principle of law governing the relations of contractors. It is doubtless well known that for certain reasons the contractors found it necessary to enlarge the circumference of the tunnel and afterward to fill in between the masonry and the excavation, with concrete, at great expense, and they sued to recover for extra work, alleging that it was necessary in carrying out the effect of the provisions of the contract, and that it was ordered by the engineers in charge of the construction. The Court holds that there can be no pretext that the work was in fact *ordered by the Aqueduct Commissioners under the provision of the contract* or that it was regarded by them as extra work or was so certified, and that the contractors should have asked for the final certificate before doing what they claimed was extra work, and that if that certificate had been withheld the courts could have been called upon to determine whether or not the work was called for by the contract. The decision upholds the established law that no recovery can be had, for *any* work done, except such work as is enumerated and described in the contract, or has been ordered by the contracting party, in this case the city. The work must be ordered, as required by the terms of the contract stipulation, or the city is not liable to pay for it.

To the contractor the meaning of this decision is that he must keep within the four corners of his contract and within its express terms; that if he does not do so, he assumes the risk of getting no returns for his labor. If the Commissioners and Engineer refused to order extra work, in the manner described in the contract, the judge says the contractors should have asked for the final certificate before performing what they claimed was extra work; and then if the certificate had been withheld, the courts could have been called upon to determine whether or not the work was called for by the contract.

The Judge's Opinion in the Air-Brake Suit.

Last week we gave the main points in the *decision* of Judge Townsend in the United States Circuit Court in the suits brought by George Westinghouse, Jr., and the Westinghouse Air-Brake Co. against the New York Air-Brake Co. We now have the *opinion*, which appears in full elsewhere in this issue. It is very voluminous and we judge that it will be a service to the reader if we give its substance in a few words, although one much interested in the matter should read the complete document, for it is learned and well reasoned. There were three bills in equity for infringement of these patents: No. 376,837, Jan. 24, 1888, to Westinghouse; No. 393,784, Dec. 4, 1888, to H. S. Park; No. 172,064, Jan. 11, 1876, to Westinghouse; No. 222,803, Dec. 23, 1879, to Westinghouse; No. 448,827, March 24, 1891, to Westinghouse.

The main defense was non-infringement and lack of patentable novelty on the theory that the inventions claimed had been described in other patents to Westinghouse not in suit. These earlier patents are chiefly No. 360,070, March 29, 1887, Westinghouse, and No. 162,465, April 27, 1875, Westinghouse, Ford and Welsh. The first mentioned covered the improved automatic apparatus used by Westinghouse at the Burlington trials of 1887. It is within the knowledge of all our readers that in the opinion of the Master Car Builders' Committee, which conducted and reported on these trials, the Westinghouse apparatus, as presented in 1887, left the field "open as wide as in 1886," and that electricity must be called in to operate the brakes on a long train. Then Westinghouse, by changes, improvements and the introduction of new elements, made the brake operate on a 50-car train in actual service, and this latter apparatus was patented in No. 376,837, the main patent in suit.

The defendants admit that Westinghouse was an original and meritorious inventor, the first to successfully use an air-brake, the first to graduate the pressure in the brake cylinder, the first inventor of the Westinghouse automatic and quick-action automatic brakes; that this last was the first practical system for long trains, and that it went immediately into successful and extensive use. But they claim that patents 360,070 and 162,465 showed how practical airbrakes could be made and worked. They admit "they have adopted these confessedly great inventions." But they deny infringement, on the ground that patents Nos. 162,465 and 360,070 imperfectly disclosed those great inventions, and are not in suit. "They further claim that the patents in suit are for mere minor improvements upon, and modifications of, said inventions, which did not require any exercise of creative thought."

The quick-action element covered by patent No. 376,837 is alleged in the suit to have been infringed. This is secured by the supplemental piston and valve in a supplemental chamber below the main slide-valve. The defendants claim that their emergency apparatus, as well as that of the patent in suit, is merely a combination of the invention described in the automatic relief valve of one patent not in suit, with the invention whereby reservoir pressure was utilized to operate an emergency valve, described in a certain other patent not in suit. The first of these patents is No. 162,465. At the date of issue both the old plain-brake apparatus and the automatic system were in use. Patent No. 162,465 was only designed for use in connection with the plain apparatus. The subject of the invention was "to provide for the more immediate escape of the compressed air from the brake cylinders after it has done its work." It was a patent for an invention, not for applying brakes, but for quickening the release of the brakes in the plain-brake system.

The defendants claim that they took their relief valve from this patent, and that Westinghouse embodied this idea in patent No. 376,837, and that it was not first conceived in said patent. They say that the first result in each case was to quicken the action of each succeeding automatic relief valve, and the difference in secondary results, that in one case it released, in the other applied, brakes, is immaterial.

The judge does not think that patent No. 162,465 anticipates or limits, in this connection, 376,837, for the whole object of the former was to *release*, in the direct or plain system. It was not adapted either to the application of brakes, or in any way to the automatic system, although that system had then been invented. This point the judge amplifies, and this part of the opinion should be read in full, for it is very important.

To the defendants' claim that the application of a device for releasing, to a different system, for a different purpose, in a different way and producing a different result, is a mere double use and a thing that any competent mechanic could do, the judge asks "why was George Westinghouse the only person to whom it occurred to do it and how to do it?" In fact, Westinghouse did not reinvent patent No. 162,465, but invented and created a new device to produce new and different results. Therefore the earlier patent did not anticipate the invention described in the patent in suit.

Then Judge Townsend considers patent No. 360,070, the first issued for the quick-action system, the one under which the apparatus tried at Burlington in 1887 was made. The defendants claimed that this patent fully disclosed another confessedly great invention, the utilization of the air, vented from the train pipe, to quicken the application. They further urge that, even if certain modifications were required in patent No. 162,465 before it could be adapted to act in the automatic quick-action system, yet that, in connection with patent No. 360,070, it showed the combination of everything vital and essential in the patent in suit.

The complainants reason that the Burlington apparatus failed, and that to make it work required something more than the knowledge of a mechanic skilled in the art.

In No. 360,070 Westinghouse sought to get both emergency and service action by the use of one piston; in 376,837 he added a separate emergency apparatus. This is the radical difference between the two patents. The defendants claim that the success of the latter was due to the use of a lift valve, as in No. 162,465, instead of a slide valve, as in No. 360,070; that it was *not* due to the use of a separate piston to operate the emergency valve. This contention the judge finds falsified by various evidence and quotes at length the evidence of Mr. Massey himself, the engineer and expert of the defendants, supporting the conclusion that "the defendants have failed to sustain the burden of proving that the conceded success of the patent in suit was due to the substitution of a lift valve instead of a slide valve."

The defendants claim that the patent No. 360,070 is for a combination where auxiliary reservoir pressure moves an emergency valve to vent air from the train pipe to the brake cylinder; that in patent 376,837 the operation was controlled by a valve actuated by the triple-valve piston, and that the patent is limited to a construction where the emergency valve is only exposed to auxiliary reservoir pressure by the excess stroke of the triple valve opening a passage. "Upon these claims, among others, is laid the foundation of the main defense, namely, that this broad, fundamental conception of the inventor, having been disclosed to the world in patent No. 360,070, they are now entitled to avail themselves of it, and to use it in connection with the suggestions contained in patent No. 162,465, in making their apparatus. They admit that patent No. 376,837 describes an improvement on patent No. 360,070, but they claim that said improvement is merely a minor invention."

The question then turns on whether or not this great invention was so disclosed to the world in patent No. 360,070 as to make it available without a further exercise of the inventive faculty. The provision of a separate emergency piston was new in No. 376,837. Further, this patent describes an improvement which was not applied for till more than six months after No. 360,070 had been granted, and after a series of experiments in themselves strong evidence "that invention was required to conceive of it." Still further, the later patent was the first practical solution of the problems of automatic, quick-action freight brakes. A most significant fact is that with patent No. 360,070 before the world, and under the stress of competitive trials no one so grasped the inventions claimed to be disclosed as to embody them in a successful working apparatus until after the patent in suit had been applied for. When the defendants constructed an apparatus they adopted the separate emergency piston and valve of the patent in suit. So the Judge concludes that the defendants, having used the same devices as were used in patent No. 376,837, infringed that patent. This conclusion is supported by a statement of the Judge's view, that the claims of the patent are not so limited in terms, or by information disclosed in the earlier patents, as to show that the defendants' device is not embraced therein. This statement is severely technical and will not very well stand condensation. In concluding it the Judge says:

I have not overlooked the distinction between the atmospheric pressure on both sides of the emergency valve of complainants, and the auxiliary reservoir pressure on one side, counterbalanced by train pressure on the other side of defendants' device. This difference does not affect the operation of the emergency piston. The concession by defendants that complainants' valve is for this reason a better valve does not seem to me to help the defendants. If the defendants have made a different construction in this respect which is inferior to that of the patent in suit by reason of its tendency to leak while retaining the other elements of the combination of complainants, it seems to me that this fact suggests that the claimed difference is only a colorable one, merely designed to get rid of the claims of the patent in suit.

The sum of all the reasoning is:

As a result of these considerations I have reached the conclusion that the first form of defendants' apparatus, the "Quick Action Triple Valve," infringes the first three claims of the patent in suit, and that the second form, the "Modified Quick Action Triple Valve," infringes the first and third claims of the patent in suit.

These claims are:

Essentially, the first of these claims is the combination of a chamber or casing having direct connection to a brake cylinder and to a train pipe respectively, a valve controlling communication between such connections, and a piston or diaphragm independent of, and unconnected with, the triple valve piston, and actuated by pressure from an auxiliary reservoir in such direction as to impart opening movement to the valve.

The second claim includes a check, or non-return valve, controlling communication between the valve and train-pipe passage of the chamber.

The third claim is for the combination, with the triple valve, of a supplemental chamber or casing having passages leading to a brake cylinder and a brake pipe respectively, a supplemental piston operating independently of the triple valve piston and adapted to impart opening movement to said supplemental valve, and a passage establishing communicction between the supplemental piston and an auxiliary reservoir.

The decision of the judge as regards the three claims is given above. Suit was brought also on the sixth claim of patent No. 376,837, which is for the combination of a triple-valve casing and a supplemental valve chamber, the latter of which, being the chamber of the emergency valve, is made in two parts, one outside and the other inside of the triple-valve casing. The defense in this particular was lack of invention and the judge considers the defense fully made out.

What we have said disposes of the opinion so far as concerns the patents on the quick-action triple valve as it is in use to-day, but the decision in the third case, being suit No. 5,315, and which grants an injunction and an accounting, is probably equally important; indeed there are some who think it much more important; therefore, we shall give a brief synopsis of the judge's opinion in that case. The suit is for infringement of claims 1 and 2 of patent No. 448,827, granted to Mr. Westinghouse March 24, 1891. This is a divisional patent, having been originally applied for as part of patent No. 376,837, discussed in the opinion, a synopsis of which we have given above. These claims are for: (1) A casing provided with supply and discharge passages and a valve controlling an exhaust port from the supply to the discharge passage, this valve being actuated to open the exhaust port by a greater than normal reduction of pressure in the supply passage, independently of the action of the triple valve. (2) The same combination, the valve being actuated to open the exhaust port by pressure in an auxiliary reservoir on reduction of pressure in the supply passage below the normal degree, in whatever position the slide valve of the triple-valve mechanism may be brought by such reduction.

The object of this invention was to provide means for effecting the rapid admission of fluid under pressure to a receptacle, co-incidentally with a reduction of pressure in a fluid supply, and the means by which this object was to be attained could be used with or without a triple-valve apparatus. All the drawings except the first show the appliance in operative relation with the triple-valve apparatus. The infringement of the claims is admitted, but the defense is that the claims are void, because they must be construed to cover the transfer of the automatic relief valve of patent No. 162,465, to the automatic system, which was a mere double use, and to cover the substitution, for the automatic relief valve of patent No. 360,070, of the valve of No. 162,465—a mere substitution, and that therefore there is no invention described in the patent in suit; moreover that certain alleged amendments are enlargements and not amendments.

The judge holds that this divisional patent fairly represents an invention distinct from those which preceded it. The problem was to provide for a certain and sure operation of the emergency valve, and to rapidly apply brakes for an emergency stop, or by means of an emergency reduction of pressure. The problem was solved by an apparatus arranged to operate independently of the triple valve, although capable of being combined with it. The essence of the invention is in providing a means by which the emergency apparatus may be directly brought into efficient operation, although the triple valve may be stuck fast. This is the distinct invention in patent No. 448,827. Taking the complete invention embodied in the three principal patents discussed, Nos. 360,070, 376,837 and 448,827, it is a fluid pressure car brake consisting of various combinations operating in different ways, the object being the successful operation of brakes on all occasions. The exigency of the sticking of the triple-valve piston is guarded against by the last of these patents. The judge's conclusion is that Westinghouse has described in this patent an improvement upon previous inventions, which was capable of use independently, and which owed its utility to its independency, and that this useful element involved the invention. Therefore in this suit an injunction and accounting are ordered.

Suit No. 4,976 is for an infringement of claims 1 and 2 of patent No. 393,784, granted to Harvey S. Park, Dec. 4, 1888, and assigned to the Westinghouse Air Brake Company. The essence of the invention is the operation of the separate emergency valve by train-pipe pressure, instead of by auxiliary reservoir pressure. This bill is dismissed, the judge holding that the defendants' first quick-action triple valve does not infringe, and it is not claimed in the action that the second form infringes.

Another charge is that of infringement of claim 3 of patent No. 172,064, issued to Westinghouse in 1876, and the defense is non-infringement, on the ground that the defendants have adopted the construction of an original patent not in suit, namely, No. 168,359, granted to Westinghouse in 1875. The decision is that this claim is not infringed.

In still another suit, No. 4,976, the charge is infringement of patent No. 222,803, granted to Westinghouse in 1879; this is on the engineer's valve. The suit is for infringement of claims 2, 3 and 4 of that patent, and the decision is for an injunction and an accounting. The defendants deny infringement, because of alleged differences of operation. It would consume too much space to follow through the reasoning of the judge in this important suit; but he reaches the conclusion that, while in some respects the device of the defendants may be an improvement upon that of the complainants, it does not show that the defendants have not appropriated the invention of the complainants, and it is well settled they have no right, in making an improvement on another's device, to appropriate his invention. The elements which are common to the two devices are vital elements, and essential to the operation of the patent, and to the achievement of the result sought; therefore, the judge is of the opinion that the defendant's device infringes the claims in suit, and he an injunction and an accounting.

We have attempted to give the essentials of this extremely important decision in such form that they may be read and appreciated without an intolerable amount of time. To understand thoroughly their bearing would require more careful study of the learned opinion of the judge than most people will find it practicable to give. It is sufficient to say that if the decision is sustained the New York Air Brake Company has no quick-action triple valve which it can make and sell.

The Law of the Boycott.

A decision of considerable importance was recently handed down by Mr. Justice Ingraham of the Supreme Court of New York, First Department, touching the legality of the boycott. Messrs. Sinsheimer, Levinson & Co., of New York, makers of clothing, with a large capital invested, were called upon by the cutters, who had joined with a voluntary society known as the United Garment Workers of America, to make certain concessions in the way of diminished time and increased wages. Messrs. Sinsheimer, Levinson & Co. declined to adopt the changes and the firm was called upon by official representatives of the United Garment Workers of America, who attempted to conduct negotiations and dictate terms quite independently of the cutters themselves, the latter being eliminated as responsible factors in the controversy. The dispute resolved itself

into one between Sinsheimer, Levinson & Co. and the United Garment Workers of America, and the fact of the relationship of employer and employee was ignored by the Union.

The demands made by the representatives of the Garment Workers were embodied in a document for the consideration of which the firm was allowed 24 hours, at the expiration of which time, upon the declination to accede to the terms proposed, a general strike was to be ordered throughout the factory. Messrs. Sinsheimer, Levinson & Co. refused to execute the contract proposed by the Union, and accordingly without further notice a general strike was ordered by the organization.

Applications were numerous from workmen, who were not members of the United Garment Association, to fill the positions vacated. But the Union did not stop with ordering and conducting a general strike; it went to far greater lengths. To quote the affidavit of a member of the firm:

"In the continued pursuance of the said unlawful conspiracy. . . . said defendants by concerted and joint action caused to be sent to the customers of the said plaintiffs in the various cities and States of the United States, circulars urging in emphatic terms the said customers to discontinue their patronage with the plaintiffs, and to cease business relations with them."

The circulars in question were printed in uniform phraseology, with spaces for the insertion of names and dates; and the result apparently fulfilled the Union's expectations. Messrs. Sinsheimer, Levinson & Co. were in daily receipt of communications from customers throughout the United States, either canceling all previous orders, or returning goods that had been shipped long prior to the trouble, or severing business relations entirely pending the continuance of the dispute. At this juncture the firm sought relief at law, and in their complaint prayed that "a temporary injunction may issue restraining the said defendants and the said association, the United Garment Workers of America," from the commission of the acts described during the action, and that the United Garment Workers of America "be permanently restrained from in any way causing a boycott of the business of the plaintiffs or from interfering unlawfully in any manner or form with their business."

This petition embodied an extremely comprehensive prayer for relief, well calculated to meet any ingenious evasions or subtle distinctions which the organization might attempt to adopt. The essential feature to be restrained, however, overshadowing in its importance all other actions on the part of the Union, was the further distribution of the boycotting circulars. The Court says:

"The serious question presented at the threshold of the case is whether a Court of Equity has jurisdiction to restrain the issuance of such circulars. . . . It has been settled in this state that a threat to do an injury to the business of a person is a threat to injure his property, and that the statements of an officer of such an association as the present defendants, that, unless a copartnership paid him a sum of money, they (the employers) could not have their employees back to work again, was a threat to do an unlawful injury to the employers' business. . . . Applying the principle of the Barondess case to the facts here stated it was an unlawful injury to plaintiff's property to send circulars to their customers which would tend to induce such customers to discontinue business with the plaintiff. . . . Courts of Equity have in all cases of continued trespass, where defendants were unlawfully injuring the plaintiff's property, and where to enforce a remedy for such unlawful acts at law many suits would be required, interfered by injunction, and I know of no principle that confines the duty of the Court to act where the unlawful acts cause an injury to real property. While the cases in which this remedy has been usually invoked have been those relating to trespass upon real property, the necessity of preventing a wrong for which there is no other remedy exists just as much where the wrong is to such personal property as to real property," and the Court concludes, "that such acts were unlawful injuries to plaintiff's property. I think the plaintiff is entitled to the injunction."

Ample justification for this determination was afforded by the decisions of the Federal Courts. In the suit of Casey against Cincinnati Typographical Union where it was held that "a combination or conspiracy by a trades union to boycott a newspaper for refusing to unionize its office is illegal and unlawful and will be enjoined by a Court of Equity," and the assurance was there given that "Equity will enjoin the publication and circulation of pasters, hand-bills, circulars, etc., printed and circulated in pursuance of such combination or conspiracy to boycott." The facts involved in that case were analagous to that of the Sinsheimer case and both decisions are strictly in line, one with the other.

Perhaps the most authoritative of the recent decisions emanating from the Federal Courts is that contained in the case of Cœur d' Alene Consolidated Mining Co. vs. Miners Union, wherein the Court very emphatically said:

When the attempt to injure consists of acts or words which will operate to intimidate and prevent the customers of a party from dealing with him or laborers from working for him the courts have with nearly equal unanimity interposed by injunction. In the one case it is an injury to a man's business by libeling it; in the other by force, threats and other like means he is prevented from pursuing it . . . . If the things done or the words spoken are such that they will excite fear or reasonable apprehension of damages and so influence those for whom designed as to prevent them from freely doing what they desire and the law permits, they may be restrained and the courts will look beyond the mere letter of the act or word into its spirit and intent."

These are broad and distinct statements and practically cover the entire field of organized boycott and intimidation. Physical damage and destruction of property is the gross and flagrant method of coercion which no court in existence will refuse to repress, but the secret and insidious circulation through the mails, and otherwise, of boycott notices containing the covert threat that unless patronage ceases the offender will himself become the victim of a similar organized opposition, represents the delicate and subtle methods of destroying property which, from its nature, is far more difficult of suppression. The corporation is of course the object of the same judicial protection as is extended to the individual, nor does the character or extent of the trade affected determine the measure of relief. Railroads as well as manufacturers are entitled to the same protection. The principle operates in all directions, whether it be as against the unlawful combinations of employers to lower the price of wages, or as against the illicit organization of employees to affect the business of their employers. The principle is distinctly enunciated that two or more have no greater privileges or can claim no higher immunity than can the individual, but that the former is rather a multiplied transgression and an aggravated trespass. The ultimate question in every instance appears to be, Does the concerted action of the malcontents tend to injure unlawfully the business of another? If such be the case, then equity may be invoked.

Railroad Bond Market in November.

In previous issues we have pointed out the fact that the enormous increase of capital in New York banks must result in a heavy purchase of railroad bonds. Last week the bank statement showed a total reserve of $189,663,100. This is an excess over legal requirements of $70,835,170, and an increase over the previous week in the surplus reserve of $6,726,350. The bank statment of Saturday showed a very encouraging feature, viz., an increase in loans of nearly $3,000,000. However, the increase in loans is not proportionate to the increase in the excess reserve, neither has it been for a number of weeks. The outlet which this money has been seeking, as is reflected by the statements, is not industrial channels. A careful study of the bond table shows that capitalists are seeking to secure interest by investment in railroad bonds. The great bulk of bonds traded in are not bought on margins, but outright, consequently the volume of transactions very nearly reflects the volume of purchases for investment account.

The average changes in the railroad stock market for four weeks were as follows: For the week ending Nov. 6 the average decline was $1.03; the week ending Nov. 11, average decline, $1; the week ending Nov. 18, average decline, 35 cents; the week ending Nov. 25, average advance of $1.31. This makes a net decline for the month of November to the 25th of $1.03. It should be considered that the average has been kept up the advances of some few so called investment stocks.

In comparison with this decline in railroad stocks the movement in the bond market indicates the attitude of capital. The following table shows the average net changes in various groups of railroad bonds for the month to Nov. 27 inclusive. The averages are struck from figures obtained by comparing the last sale of November with the last sale in October.

Roads in receivers' hands	Net advance,	$2.72
Grangers	"	2.60
Trunk lines	"	1.725
Transcontinental lines	"	2.45
Southwestern lines	"	3.45
Coal lines	"	1.68
Miscellaneous railroads and industrial bonds	"	2.90

The table of fluctuations of bonds of roads in the hands of receivers is of particular interest. It shows both the most pronounced advances and declines. In other words it indicates a discriminating market. The quotations of all excepting perhaps first mortgages were marked off in discount of the receiverships. Consequently it may be said that at the beginning of the month they were on bed rock. Any improvements in these quotations naturally indicates a belief on the part of capital that the affairs of the various roads are being worked into better shape. This is particularly noticeable in the Erie funded 5's as well as the 2's. London was a large holder of these securities, and has got the idea that the road is to be reorganized on a basis favorable to the bondholders. East Tennessee Consol 5's, which dropped off when the interest was defaulted, advanced 8¼ points. This appreciation was on the generally accepted idea that the interest would be paid before the expiration of the three months of grace. Reading issues did not keep pace with the advance in the stock, owing to the fact that they are not in demand as an investment security, and that they were depressed to a greater or less degree by the examination of Expert Accountant Stephen Little into the affairs of the company. Union Pacific issues all improved materially, owing to the very prompt measures which are being taken toward a reorganization. There is a particularly comfortable feeling in the Street over the affairs of this company, owing to the strong committee, headed by Mr. J. Pierpont Morgan, which has taken hold of the reorganization. The decline in Richmond Terminal 5's and 6's was due to the steadily crystallizing belief that the reorganization plan will not go through.

While the grangers do not lead in point of advance they indicate much more stability. A comparison beween the prices of the granger group and the receivers' group shows unmistakably that the condition of the roads is reflected in the prices for their bonds. It is well to note in this connection that the fluctuation in the grangers was much less pronounced than those in the receiver roads. Being more stable they will undoubtedly come in for a heavier demand from capitalists who are at the present time very discriminating, while the receiver group, especially the lower priced securities, were sought by the speculative element in the market.

The Trunk line bonds are already very high compared with other issues and even a heavy buying movement will not have the tendency to advance them materially.

In the Transcontinental group Atchison securities do not show any material improvement. This is probably due to the very bearish attitude of Wall Street towards the stock, which has been selling for some time very near receivership prices.

The Southwestern group shows the lowest quotations of any, except, perhaps, the receivership group. This is due to the prolonged depression which has ruled in the Southwest, and the fact that many stocks like Missouri Pacific, Texas Pacific and others reflect the enormous decreases in earnings. This group, owing to such low prices, has shown the most substantial average advance, the demand being partly investment and partly spoculation.

Little can be said of the coal group beyond the fact that it reflects the general improvement both in the bond market and the coal world.

The Miscellaneous group, which includes a number of the industrials and local railroad issues, taken as a whole indicates that the buying of railroad bonds has not been caused by any material improvement in the railroad situation, but that the depreciation in prices has been caused by idle capital seeking investment. In this list, barring General Electric's debenture 5's, which declined 5 points in sympathy with the drop in the stock, the industrials show about the same improvement as the railroads. Of the miscellaneous railroad securities the Rio Grande 1's advancing 6¾ points, and Denver & Rio Grande 4's, 6¾ points, are taken as indicative of the improvement which will accrue to the silver producing district now that the Sherman silver law has been repealed, all inflation in the silver industry reduced, and the industry itself placed on a certain and normal basis. In this list it will be seen that those bonds which secured the greatest advances were the cheapest—not intrinsically, but as compared with par.

The guaranteed bonds of such roads as Lake Shore, Lackawanna, Delaware & Hudson, Chicago & Alton, C, C., C. & St. Louis, Illinois Central, Michigan Central, Milwaukee, Lake Shore & Western, Nashville, Chattanooga & St. Louis, Pennsylvania, St. Louis, Alton & Terre Haute and Wabash were not dealt in to any extent. But where there has been a sale during the last week or two, the bid prices are from one to four per cent. higher than the previous sales.

In the tables which follow we give the highest and lowest prices for November and the last sale to the 27th inclusive. The change is the difference between the last sale of this month and the last sale of October. Generally speaking, the last sales are near the highest for the month, in many cases being the highest. This shows unmistakably the strength in the bond market at the present time.

The bond market for the last week was very strong. Inquiry among bond houses Tuesday morning showed a continued investment demand. There was little or no cancellation of orders despite the drastic measures of the tariff bill. Second-class bonds are being taken more freely than they were a week ago. Europe has been a large buyer of bonds the last month; on several occasions more than the insurance companies were willing to insure by one steamer.

The largest advances during the last week were as follows: Atchison 4s, 1⅛ per cent., Atchison 2ds, 1¾ per cent.; Beech Creek 1sts, 2 per cent.; Chesapeake & Ohio 5's, 1 per cent.; Chesapeake & Ohio 4½'s, 2 per cent.; C., B. & Q. conv. 5's, 1⅝ per cent.; C., B & Q. 7's, 2½ per cent.; Canada Southern 1sts, 1 per cent.; Chicago & Northern Pacific 1sts, 2½ per cent.; Chicago & Eastern Illinois 5's, 2½ per cent.; Colorado Coal 1sts, 3 per cent.; Chicago Gas Light & Coke 1sts, 2½ per cent.; Duluth, South Shore & Atlantic 5's, 5¼ per cent.; Erie 2ds, 6½ per cent.; Erie funded 5's, 11 per cent.; Fort Worth 1sts, 6½ per cent.; Hocking Valley 5's, 2 per cent.; Iron Mountain 5's, 4 per cent.; Kansas Pacific cons., 6¼ per cent.; Kansas & Texas 4s, 2⅜ per cent.; Kansas & Texas 2ds, 3⅛ per cent.; Louis., N. A. & Chicago gen. 4's, 3 per cent.; L. E. & St. L. 1sts, 7½ per cent.; Northern Pacific con. 5's, 1 per cent.; Jersey Central gen., 3 per cent.; Ontario & West. 4's, 1¼ per cent.; Oregon Improvement 5's, 3⅛ per cent.; Rock Island 4's, 1 per cent.; Rio Grande Western 1sts, 6¼ per cent.; Manitoba con. 6's, 1⅛ per cent.; Montana ex. 4's, 4 per cent.; St. Paul Terminal 5's, 1¾ per cent.; St. Louis & Southwestern 1sts, 2 per cent.; Texas Pacific 1sts, 3½ per cent.; Third Avenue 5's, 2¼ per cent.; Union Pacific gold note 6's, 6 per cent.; Wabash 1sts, 1⅝ per cent.; Wabash 2ds, 2¼ per cent.; and Western Union col. 5's, 1⅝ per cent.

Roads in the Hands of Receivers.	Range for November. Highest.	Lowest.	Last sale.	Change from last sale in October.
New York, Lake Erie & Western:				
Erie 2ds	75½	65½	75	+ 7¾
Erie Funded 5s	75	64	75	+15
East Tennessee 5s	89	80	88½	+ 8½
Wis. Central 1sts	75	68	70	.....
Northern Pacific 1sts	110½	108½	109½	+ ½
" " 2ds	90¼	87	88	− 3
" " 3ds	69⅝	65	66¾	− 2¼
" " 5s	36	31½	33¼	− 1¾
Chicago & Nor. Pacific 5s	50	43	49½	+ 6½
Reading 4s	72⅜	69¾	72	+ 2½
" 1sts	36⅜	33	35¼	+ ⅛
" 2ds	26	22¾	24¼	+ ⅛
" 3ds	20½	18	19¾	+ ¾
Union Pacific 1sts, '96	104¼	102	104¼	+ 2
" " '97	104¾	102½	104¾	+ 2¼
" " '98	106	104	106	+ 2
" " '99	106⅞	104½	103⅞	+ 2⅝
" " gold notes 6s	92	80½	92	+ 13
U. P., D. & G. 1sts	45¾	40	44	− 1¾
Kansas Pacific cons. 6s	89½	78	89½	+ 9½
Ore. Short Line & U. N. con	49	44½	48¾	− ¼
Ore. Short L ne 6s	90	81	80	+ 5½
Rich. & West P. Ter. 5s	24¾	20	21	− 3
" " " 6s	49	42	45	− 2
Average advance, 2.72.				
Grangers.				
Chic., Burl. & Q., conv. 5s	103	100½	103	+ 2½
" " " 7s	122¾	119	123¾	+ 3¾
" " " deb. 5s	99¾	97	99¾	+ 2¼
Rock Island ex. 5s	101½	97½	101½	+ 3
" " deb	94¾	92	94¾	+ 2¼
St. Paul 1st 8s	116	115	116	.....
" Dak. & Gt. So. div. 5s	105	103	105	+ 2
" Terminal 5s	107¼	105	107¼	+ 2¾
" Chi. & P. West 1st 5s	110	108½	110	+ 1⅝
" South. Minn. div	115	114	115	+ 2⅛
Mil. & Nor. 1sts, 1910	115⅞	112½	115⅞	+ 6⅜
" " 1913	115¾	111¼	115¾	+ 4½
Northwest S. F. 5s	107	105	106½	+ 1
" Con. 7s	138	131½	138	+ 1
" 25-yr. deb	102½	100¼	102¼	+ 1½
Average advance, 2.60.				
Trunk Lines.				
Pennsylvania 4½s	108¼	106	108⅝	+ 1
N. Y. Cent. 1st 7s	125½	123	125½	+ 2¼
Beech Creek 1sts	100	96¾	100	+ 2½
Rome. W. & O. ex. 5s	112½	109¾	112½	+ 2
West Shore 4s	103⅞	102¾	103⅞	+ ⅞
Average advance, 1.725.				
Transcontinental.				
Atchison, Topeka & S. Fe 4s	74	70	73½	+ ½
" " " " 2ds	42⅜	36¼	40	.....
Col. Midland 4s	42¾	40	42	− 1
St. Paul, M. & M. or Great Northern:				
St. Paul, M. & M. con. 6s	119½	117½	119½	+ 4½
" " " 4½s	102	100	102	+ 2½
" " Mon. Cen. 6s	114¾	110	114½	+ 4½
" " " 5s	100	97	100	+ 5
" " Mon. Ex. 4s	92	87	91	+ 4
Average advance, 2.45.				
Southwestern.				
Int. & Great Northern 2ds	68	62½	67	+ 7
Kan. & Texas 4s	82¾	78⅛	82⅛	+ 3⅛
" " " 2ds	47½	43¾	47⅜	+ 5⅜
Iron Mountain 5s	80	73	80	+ 7
St. L. & Southwestern 1sts	60¾	56½	60¼	+ ¼
" " " 2ds	21	18½	20⅜	+ 1⅜
Texas Pacific 1sts	79⅛	74½	79	+ 5
" " 2ds	21½	19¼	21½	+ 2⅜
Wabash 1sts	104¼	101¼	103¾	+ 2
" 2ds	77	74¼	77	+ 2¼
Average advance, 3.45.				
Coalers.				
Jersey Central gen. 5s	112	109	112	+ 2½
N. Y., O. & W. 4s	84¼	82¾	84¼	+ 1⅝
" " " con. 5s	109	107	108¼	+ 2¼
Southern.				
Lou. & Nash. gen. 6s	116	114½	116	+ 2
" " gold 4s	78½	77	77	.....
" " con. 7s	110	108	110	+ 2
Average advance, 1.68.				
Miscellaneous.				
Am. Cotton Oil 8s	112¾	110¾	111	+ 1
Brook. Elev. 1sts	108	107	107	− 1
Ches. & O. con 5s	104	101¼	104	+ 3½
" " gen. 4½s	77¼	74	76⅞	+ 2⅞
Can. Southern 1sts	108¾	106	108¼	+ 2¼
" " 2ds	101⅛	98½	101⅛	+ 3
Chic. & E. Ill. gen. 5s	99¾	97	99¾	+ ¾
Colorado Coal 6s	97	91	97	+ 5
Chi. Gas L. & Coke 5s	89	84½	89	+ 4½
Den. & Rio Grande 4s	80	73	80	+ 6¾
Dul., S. S. & Atlantic	103	96	103	+ 7
Elis. Lex. & B. S. 6s	100	95	99⅞	+ 4⅞
Edi. Elec. Ill. 1sts	105	103¾	104	− ⅛
General Elec. deb. 5s	81	71	74½	− 5
Hocking Valley 5s	91	88	91	+ 2
" " 6s	95½	93	95½	+ 2½
Kana. & Mich. 1st 4s	75	73	75½	+ 1½
Laclede Gas 1sts	84¾	81¼	84⅛	+ 3⅛
L., N. A. & C. con. 6s	101¼	97	101¼	+ 3¼
" " " gen. 4s	70⅞	66½	70	+ 1½
L. E. & St Louis 1sts	70½	60	69	+ 9
Lake Erie & W. 1sts	112	109¾	112	+ 3½
Long Island 4s	97	95	97	+ 2
Metropolitan Elev. 1sts	119¼	116¾	119¼	+ 1¼
" " 2ds	107½	101½	107½	+ 3
Mobile & Ohio gen. 4s	60	55	59½	+ 4
N. Y., C. & St. L. 1st 4s	96⅞	95	96⅞	+ 1⅞
Ore Improvement 1st 6s	100	95	100	+ 3½
" " 5s	55⅝	49	55	+ 5½
Pitts. & Western 1sts	88	83	88	+ 4⅛
Ren. & Saratoga 1sts	140½	138	140¼	+ 2¾
Rio G. Western 1sts	74½	67½	74	+ 6⅜
Third Avenue 1sts	114	111	114	+ 4
Tol. & Ohio Cen. 1sts	106¼	105	106¼	+ 1¼
Union Elevated 1sts	104¾	101	102	− 2
Western Union Col. 5s	105½	102	105½	+ 3½
Average advance, 2.90.				

Annual Reports.

Richmond, Fredericksburg & Potomac.—The report of this company is for the fiscal year ending June 30, 1893, and it is interesting to note that it was presented at the sixty-first annual meeting of the stockholders. There are few railroads in the world which can trace their history back so far. The miles operated were 85.04, and the principal results of operation were:

Gross earnings	$783,400	Increase	per cent., 5.2
Operating expenses	497,433	"	" 9.2
Net earnings	285,967		
Ratio operating expenses to earnings		63.6	per cent.
Dividends	156,660	(being 7 per cent.)	
Surplus	47,100		

The main items of increase inoperating expenses are Maintenance of way, $8,900, accounted for by actual betterments; maintenance of equipment, $12,099, accounted for by additions; conducting transportation, $17,943, largely due to increased train-mileage. This increase was over 10 per cent. of the revenue miles, and about one-half of it was in passenger train-miles, much of the latter having been caused by disturbances of the customary schedules of connections over which the road could have no control.

The ton-miles were 38,693,111, an increase of 9 per cent., and the rate per ton per mile was 1.029 cents, as compared with 1.047 the year before. It was, in fact: the lowest rate ever received by the company. The passenger-mileage was 14,131,485, an increase of 14 per cent. over last year. The rate per passenger mile was 2.353 cents, as compared with 2.419 that also being the lowest recorded rate. The President says that the company is in normal condition, has been free from any serious train accidents, and despite the pronounced decline in earnings that must be expected the next year, the Board expects to maintain the usual dividends.

A very interesting table is published covering the principal facts of the business of the road for the last 14 years. In that time the ton-miles have increased about 10 times and the passenger-miles have something more than doubled. The rates, however, have fallen from 3.41 cents per passenger-mile and 2.21 per ton-mile to the figures quoted above, and the ratio of operating expenses to gross earnings has risen from 53.1 to 63.6. The revenue per train-mile has fallen from 193 cents to 134, but the gross revenue per mile operated has increased, every year for the 14 years, from $4,044 to $9,197. The average freight-train load was 106.13 tons, and the average haul 68.85 miles. The average passenger-train load was 49.53, and the average passenger journey 43.34. There are several unusual and interesting tables which give actual information often wanted, not only by stockholders, but by others who have occasion to hunt up statistics of railroading.

Buffalo, Rochester & Pittsburgh.—This report is for the year ending June 30, 1893, the total road operated having been 304 miles, and the sidings 97 miles, which, it will be observed, is a very good percentage of sidings. The chief results of operation follow:

Gross earnings	$3,354,464	Increase	11.83 per cent.
Operating expenses	2,357,411	"	13 19 " "
Net earnings	997,053	"	8.73 " "

The ratio of operating expenses to earnings was 68.81 per cent. as compared with 72.14 last year. The greatest increase in earnings was from freight; the increase being 13.05 per cent. as compared with 4.04 increase from passenger earnings. The traffic of the road being so largely coal the average ton mile rate is necessarily low, having been last year 0.55 cent. The tonnage of bituminous coal was largely increased, viz.,, 14.84, and the total ton-miles of this freight were 362,536,859, as campared with 174,423,624 in 1887, the increase having been steady for the last four years. The total ton-mileage of coal and all other freight last year was 492,021,357, which is a little more than twice ton-mileage in 1887. The average haul last year was 147.86, but we have not the freight train mileage, and therefore do not know the average load.

The increase in passenger earnings was due to slight increase in the rate per mile as well as an increase in the passenger miles.

The bonded debt was increased $1,325,000 during the year, the greatest addition, $750,000, having been made on account of the construction of the Johnsonburgh & Bradford Railroad. The other large items were $250,000 of general mortgage bonds applied to cost of road and equipment and $301,000 in car trust bonds. The total expenditures for new equipment during the year were about $689,000, and after certain credits the net charge to equipment account was $605,000.

The Johnsonburgh & Bradford Railroad, which was opened for traffic on June 1 for 19½ miles, extends from Howards, Pa., to Mt. Jewett, Pa., and is a substantial line, with 80-lb. rails, oak cross ties, ballasted throughout and provided with long sidings every five miles. When fully completed the cost of this road is expected to reach $900,000. The Clearfield & Mahoning Valley Railroad was also opened for traffic during the year, and is another line of the same description as the Johnsonburgh & Bradford. It is nearly 26 miles long, extending from Du Bois Junction to Clearfield, Pa.

The Interstate Commerce Commission has issued a decision, written by Commissioner McDill, on the complaint made by the Populists of California that the Southern and the Union Pacific railroads made an unjust discrimination in refusing them the reduced rates to their national convention, which were granted to the California delegates to the Republican and Democratic national conventions. The substance of the decision is as reported in the newspapers, that as Section 22 of the Interstate Commerce law expressly exempts excursion tickets from the operating of that law, the Commission can entertain no complaint of this nature. In other words, discrimination between rival applicants for excursion rates, no matter how gross, must go unpunished. The reduced rate made for the Republicans and Democrates in June was open to the public at large, as well as to delegates. Moreover, there was a cash guaranty of 150 passengers, whereas the Populists would guarantee only 36 passengers. This being the state of the facts the argument of the railroads that the smaller number did not justify a reduction, while the larger number did, would appear to be a strong business reason for the discrimination. But, as we have just said, the report of the Commission lays no emphasis on this point. There is, however, some discussion of the claim that in such a public matter the political parties ought to be treated alike, and there is a paragraph at the end of the report which says that with a proper observance of the spirit of the law, "which seeks equality and condemns invidious discriminations," excursion rates would be granted to each national convention. While Commissioner McDill's reasoning does not go into the matter very deeply, his conclusion on this point is doubtless fair. It might, indeed, be to the interest of the railroad company to refuse a reduction to the large parties, or to make a very small one, if such reduction involved giving a similar favor to a small party; for, no doubt, the reduction that was made was decided upon largely in view of the possibility of attracting outsiders—that is, those who were not delegates. If we consider the question of cost, probably a party of 36 ought to receive nearly as large a reduction as a larger party, if they would all ride on one train, for the unit which most affects the cost is the carload, and 36 persons make a good carload. As is well known, nearly all railroads accept 18 persons as a carload, and will run a car for 18 tickets, however small the actual number of passengers. If the Populists are made fully aware of this fact they will probably make a louder complaint if they are not favored with a reduction when their next national convention comes around—that is, if they ever have another.

The business of insuring railroad companies against losses due to the injury of persons in train accidents seems to have gone to smash. In discussing the subject in the *Railroad Gazette* of Sept. 22, we referred to the unsuccessful nature of this business as evidenced by the results which appeared in connection with two or three serious train accidents; and now it is reported that the American Casualty Insurance & Security Co., of Baltimore, is practically insolvent, the number of claims presented to it lately, and now remaining unsettled, aggregating ten million dollars. Even if we reduce this figure by the percentage representing the usual difference between sums claimed and sums actually paid, the amount of liability still remains large and illustrates the the fact, which is the underlying reason for the failure of schemes of this kind, that there is no reliable basis for estimating beforehand what the railroad accidents of a given year will cost. The bearing of this fact is of course intensified when we try to apply the average to a small number of railroads, as seems to have been necessary in view of the fact that not many roads saw fit to take out policies of this kind. The reports in the newspapers indicate that the company named was a weak one at best, and it was incorporated in Maryland apparently because it could not obtain legal recognition in states like New York and Massachusetts, where the insurance laws are strict. The roads which have paid premiums are likely to have to pay some damage bills also. It is said, however, that the insurance department of the State of New York has $250,000 which the Casualty company deposited as a guaranty fund when it was permitted to do business in the state. This company seems to be the only one of any consequence that has gone into this business. A Chicago dispatch states that the Chicago & Eastern Illinois is one of the roads interested in the failure. Street railroads in Chicago, St. Paul, St. Louis and other Western cities were among the largest customers of the insurance company, and the West End Street road of Boston was also one. The managers, Beecher, Schenck & Co., are accused of indulging in very loose business practice.

The best summary of the train robbing industry that has yet appeared is a historical sketch entitled "Highwaymen of the Railroad," by William A. Pinkerton, in the November number of the *North American Review*. The author gives sketches from his experience as a detective since 1865, embodying accounts of the principal exploits of train robbers. Mr. Pinkerton holds that the recent "epidemic" is due largely to the general business depression and to the reading of yellow covered novels by country lads, whose minds thus become inflamed, making them easy victims of professional thieves who invite them to join their schemes. Once a boy starts as an amateur he is likely to become infatuated with the work and he then sticks to it until he is imprisoned or killed. Train robbery is not a profitable pursuit, the chances of escape being not one in a

hundred, says Mr. Pinkerton. The article cites an instance of a local magistrate in Missouri who dared not inforce the law; and the state of things indicated by this, together with the fact that all successful work hitherto done has been at the instance of the express companies, who have proceeded irrespective of state boundaries, is put forward as an argument for national legislation to repress these crimes. It is stated that the express companies are seriously considering the advisability of increasing the rates on money, so that the banks will be forced to send it by mail, thus making a robbery an offense against the postal laws.

New York's Rapid Transit Commissioners have again laid down a route for an elevated railroad. It is on the west side, up West street and Seventh avenue, with an additional downtown line from near the City Hall by way of Centre street, Wooster street and West Fourteenth to Seventh avenue. We not take the space to give the route with more particularity, for the chances are ten to one that like all the other projects brought forth by this astonishing Commission it will come to nothing. It will be observed that it expects the contracting company to build a long downtown line, on the extreme west side, in a region which probably cannot yield any net returns from operation after paying fixed charges, and that the profitable downtown end only runs as far south as the City Hall, leaving the great region from there to the Battery unprovided for. Either one of these lines would be a great public convenience and would be valuable as auxiliary terminals or as feeders for the existing lines, but that any capitalist will venture his money on building them as independent lines is exceedingly improbable.

TECHNICAL.

No Trolley Lines for Chicago.

Two weeks ago an ordinance was introduced in the Chicago City Council the passage of which would allow the street railroad companies of the North and West sides of the city to change their present method of propelling their cars to the electric system with the overhead trolley. The amendment would allow the trolley system to be operated to the business center. The members of the Council are decidedly against the system for surface car lines in the business portion of the city and the thickly populated residence portion, as shown by the fact that the Railroad Committee, to which the above amendment was referred, voted unanimously to file it. It is very doubtful if the Council would vote to allow it to be introduced even though instructed to do so by the people they represent. The Aldermen are not in favor of the trolley for the thickly populated portions, but if petitions signed by property-owners, along proposed lines are presented, with ordinances granting the companies permission to use the system, the Aldermen will grant such permission. Under such conditions no responsibility would rest on the Council. The Chicago City Railway, operating horse, cable and electric lines on the South Side, is asking property-owners along some of its lines for permission to use the overhead trolley; and if a sufficient number of such owners sign the petitions, the Council will, without doubt, pass suitable ordinances.

Perls' Automatic Block System Apparatus.

An apparatus for automatically keeping trains a certain minimum distance apart when running on the same track, invented by M. & T. Perls, was tested in a public exhibition on the Royal Military Railroad near Berlin, Germany, on Oct. 18. Among those attending the test was Gen. Von Knappe, Chief of the Railroad Brigade of the German Army. It is said that the test was entirely successful. The principle of the apparatus is similar to that of several such devices that have been brought out in this country, an electro-magnet being placed on each locomotive and connection from one train to another being made by means of an electrical conductor in the shape of a rail which is laid upon the ties between the rails of the track. The address of the inventors is 62 Basinghall St., London, E. C., England.

Car-Heating Patents.

The interference case between the Safety Car-Heating & Lighting Company and other companies has been decided by Commissioner Seymour, of the Patent Office, in favor of the Safety Car Heating & Lighting Company. The case involved the right to a patent on that system of car heating which takes steam from the locomotive, conducts it by train pipe and heats the cars supplied with the hot-water system in connection with the Baker heater or any similar heater. The patent covers the broad principle of heating the water of the water-pipes of the Baker or other heaters, whether by jacketing, coils or other devices with steam from the engine by way of the train pipe. The constructive patents were issued some time ago, but the grant of the broad claim was withheld until the several companies had a hearing. The Consolidated Car-Heating Company and the Gold Car-Heating Company are licensees of the Safety Car-Heating & Lighting Co. to use this principle and were plaintiffs with them in the interference case. The award is made to the Safety Car-Heating & Lighting Co., who are assignees of the patentee Towne, on grounds of priority of application, and sustains a prior decision of Commissioner Simonds. By the present laws of the states of New York and Maryland railroad companies are required not to use any stove or furnace, and the laws of Connecticut, Maine, Massachussetts, Michigan, New Hampshire, Rhode Island, Vermont and perhaps others, require that railroads shall use a system of heating approved by the Commissioners. The system protected meets the laws of New York and the other states named, and is important as the cars can also employ fires in the heaters when they pass into other states or have not steam train pipe.

THE SCRAP HEAP.

Notes.

The New York Bureau of Contagious Diseases sends physicians to the elevated railroad terminals to vaccinate trainmen by wholesale.

The Executive Committee of the American Ticket Brokers' Association announces that the Association will spend $1,000 to aid in detecting the perpetrators of the forgeries of tickets at Chicago last month.

The Baltimore & Ohio has announced a new passenger train to run between Chicago and Pittsburgh, and this is followed by a similar notice from the Pennsylvania the latter to be a night train and to be put on Dec. 4.

The trial of President Van Horne and other officers of the Canadian Pacific, for violation of the Interstate Commerce Law in the sale of a ticket, which was to have come off at Tacoma, Wash., this month, has been postponed until February.

It is reported from Pittsburgh and from Fort Wayne that the Pennsylvania Railroad and the Pennsylvania Company are reducing the forces in various departments and shortening the working time in shops in order to effect a reduction of expenses.

At the meeting of the International Committee of Young Men's Christian Associations, in New York City, last week, the Secretary of the Railroad Department reported that railroad companies had contributed $130,000 to the work of the associations during the past year.

The Cleveland & Marietta has laid a "switchback" track around the Kimbolton (Ohio) tunnel, which has been obstructed by fire for about three months. The Wickes tunnel, on the Great Northern, was blocked by a cave-in last week, and it is said that it will take six weeks to clear it out.

On the night of Nov. 25 a freight train of the Lake Shore & Michigan Southern was cut in two while running near Goshen, Ind., by eight tramps who overpowered the trainmen and beat them. It is said that the tramps tried to stop the rear portion of the train for the purpose of wrecking a following passenger train.

At Williamsport, Pa., last week 15 employees of the Philadelphia & Reading repair shops were fined $4 each for working on Sunday. The convictions were secured under a law of 1794, and, according to the local newspapers, the arrests were made at the instance of a man who was discharged by the road for refusing to repair cars on Sunday.

The last Legislature of Indiana passed a law empowering County Commissioners to require flagmen at all railroad crossings where two or more tracks are used for switching. The railroads contested the law and in a suit filed by the state against the Pittsburgh, Cincinnati, Chicago & St. Louis, the Circuit Court of Blackford County has decided that the law is unconstitutional, on the ground that there is no provision for notice to the railroad company before the issue of an order.

The South Carolina Railroad, which is in the hands of a receiver appointed by the United States District Court, is now carrying liquor regardless of the laws of that state forbidding individuals to ship or receive it. It appears that the state authorities have dropped the lawsuit which they instituted to settle the status of the law as it relates to Interstate Commerce in liquors, and the Court which is operating the railroad has therefore instructed the Receiver to "receive all goods in the usual course of trade."

A roundhouse and other buildings of the Newburgh-Dutchess & Connecticut road were burned at Dutchess Junction, N. Y., last week, together with 12 freight cars; loss, $40,000. A repair shop of the Chicago & Grand Trunk was burned at Fortieth street, Chicago, last week; loss, $50,000. The passenger station of the Chicago & Grand Trunk at the western end of the St Clair tunnel, Port Huron, Mich., was burned on Nov. 26, the loss being about $25,000. The fire started in a room where were stored a large number of fusees.

The testimonial given by the Illinois Central Railroad and the American Express Co., to the conducter, engineer, fireman, two brakemen, baggageman and express messenger who repulsed the train robbers near Centralia, Ill., on Sept. 20, took the shape of a gold medal of maltese cross pattern, with a suitable inscription, and the presentation was made by General Manager Harahan of the railroad, and Mr. Trumbull, of the express company, at Centralia, on Nov. 21. In addition to the gold medal each of the seven men received $300 in shares of Illinois Central Railroad stock.

The Northern Pacific has issued a circular announcing reductions in the pay of all employees earning over $50 a month, to take effect Jan. 1. The amount of the reduction in the pay of enginemen, trainmen, yardmen and operators is not announced, but all the schedules for these classes will be abrogated, and it is understood that the reduction will be about eight per cent. The salaries of employees paid by the month and receiving between $50 and $75 a month will be reduced five per cent., and of those receiving from $75 to $100, 10 per cent. All salaries over $100 were reduced on Aug. 17 from 10 to 20 per cent.

Lake Notes.

Besides the enormous coal dock being built at the head of Lake Superior by the Northwestern Coal Railway Co, the Lehigh Valley will also build. The foundation for the N. C. Ry. dock will be completed early next year, and the dock itself three years later, though part of it will be ready in 1894.

In lieu of a bridge between Duluth and Superior the navigable water is to be crossed this winter for street car travel by a combination boat and sledge, to run either on ice or water as the case requires. Electric power will operate an endless cable.

Bonds Listed at the Stock Exchange.

The following railroad securities have been listed on the New York Stock Exchange:

Louisville, New Albany & Chicago.—Additional issue of preferred six per cent. stock, $1,500,000, making total amount listed $4,500,000.

Central of New Jersey.—Additional issue of general mortgage five per cent. bonds, 1,000,000, making total amount listed $6,415,000. These bonds are issued to pay for new property and equipment, including tracks, extensions, land purchases and stations.

Willmar & Sioux Falls.—Additional issue of first mortgage six per cent. bonds, $1,000,000, making total amount listed $3,625,000. These bonds are guaranteed by the St. Paul, Minneapolis & Manitoba and the Great Northern, and are issued upon 58 miles of new road between Sioux Falls and Yankton, S. D.

Chicago & Eastern Illinois.—Additional issue of general consolidated first mortgage 5 per cent. bonds, $946,000, making total amount listed $7,393,000. They are issued on account of the construction of 34 miles of single-track road, 10 miles of double track, and new equipment.

Toledo & Ohio Central.—Additional issue of first mortgage Western division 5 per cent. gold bonds, $837,000, making total amount listed $2,112,000. They are part of an issue of $2,500,000 authorized for the construction of the company's Western division from Toledo to Columbus, O.

Ohio Southern.—Additional issue of first mortgage 6 per cent. bonds, $1,132,000, making total amount listed $3,232,000. They are issued upon 67 miles of new road from Springfield to Lima, O., and an extension to Wellstown.

Cleveland, Cincinnati, Chicago & St. Louis.—General mortgage 4 per cent. bonds, $3,000,000. The proceeds of these bonds have been used to acquire additional terminal facilities and equipment and for new construction.

Soap.

A kind of soap, spoken of in the *Revue Industrielle*, and containing ground glass and emery of different degrees of fineness, has recently been put on the French market and is recommended for polishing iron and wood and for all the usual purposes of sand and emery paper. It may be used either dry or after having been dampened.

Another Hundred-Mile-an-Hour Railroad.

We are informed that "an important meeting of capitalists was held in Cleveland, O., the other day at the residence of Dr. J. C. Anderson. Ex-Secretary Foster was one of the conferrees. The meeting had under consideration a scheme for the construction of a double-track elevated electric railway from New York to Chicago, to cost $100,000,000. A speed of 100 miles an hour is to be maintained. Only a passenger and express business will be done. A survey has been made, and plans at present run the line through Philadelphia, Pittsburg, Cleveland and Toledo. Dr. Anderson controls the more important patents. It is said that capital enough has been pledged to insure the success of the project." We are surprised at the moderation of Dr. Anderson. Why did he not tell the eager public, which is waiting to buy hundred-mile-an hour, electric railroad shares, that the road could be built for 50 millions of dollars and run 200 miles an hour? He is a servile imitator of Dr. Wellington Adams, and we can assure him that Dr. Adams has taken the cream from that kind of a railroad. Furthermore, when he gets ready to actually float his stock we will undertake to demonstrate that his road will cost nearer 400 million than 100 million, before he puts a wheel on it or builds a powerhouse.

The Ann Arbor Strike Once More.

The Supreme Court of the United States on Nov. 27 dismissed the appeal of James Lennon, the Lake Shore & Michigan Southern engineman who was fined $50 for contempt of court in refusing to move a freight train, because it contained freight for the Toledo, Ann Arbor & North Michigan Railroad, after the United States Court had issued an injunction forbidding such discrimination. The substance of the Supreme Court decision is that the case does not come within the provisions of the law of March 3, 1891, concerning appeals in habeas corpus cases.

Incline Railroad at Hamilton.

The new incline railroad at Wentworth street, Hamilton, Ont., is likely to become an accomplished fact, and the company has applied for incorporation. The estimated cost is placed at about $25,000. Mr. J. W. Lake has left for New York to consult with engineers about designs for new machinery.

LOCOMOTIVE BUILDING.

The Atchison, Topeka & Santa Fe has placed an order for 91 locomotives, the largest single order that has been given by any one company for many years. The Baldwin Locomotive Works are to build 70 of the engines, and the Richmond Locomotive Works the other 21.

The Pennsylvania has just completed at its shops at Fort Wayne, Ind., the last of the 22 Class X engines ordered early in 1893. Most of these engines were built for the lines east of Pittsburgh.

The Baldwin Locomotive Works are building 10 locomotives for the Philadelphia, Reading & New England, six of the engines being compound freight locomotives and the balance compound passenger engines.

The Richmond Locomotive Works is overhauling 10 consolidation engines of the Peoria & Eastern road. The company has an order for building 21 locomotives

for the Atchison, Topeka & Santa Fe, as stated elsewhere. This order includes 10 consolidation engines and ten 10-wheel locomotives.

The statement in these columns last week concerning the change to full time in the shops of the Baldwin Locomotive Works needs one qualification. The maximum force employed early in the year was 5,400 men. This number was gradually reduced to 2,400 men and this force has been employed on about half time during the summer and fall. About a week ago the men were put on full time in order to finish up some locomotives for the New York, Lake Erie & Western, part of the contract for 50 which was let early in 1893. About 33 of these locomotives were completed when the railroad receivers were appointed, and the work on the balance of the order was then stopped, although the engines were practically ready for delivery. They are now being delivered.

BRIDGE BUILDING.

Atlanta, Ga.—The Alabama street bridge project was referred to in this column a few weeks ago. It appears that there is not as good a prospect for an immediate decision in the matter as then appeared probable. The City Council has the matter under advisement, but as yet has taken no definite action, and it is now apparent that nothing will be done until next January, at the earliest.

Baltimore, Md.—Proposals to build a bridge on Maryland avenue over Jones' falls were opened this week. The bids were as follows: Pennsylvania Steel Co., $13,489; Edge Moor Bridge Works, $14,400; H. A. Ramsay, agent, $15,394; Campbell & Zell Co., $16,995.08; Penn. Bridge Co., $17,332; Pencoyd Iron Works, $17,615; G. W. Drury, agent, $18,200; New Jersey Steel & Iron Company, $18,554; King Bridge Co., $18,781; Berlin Iron Bridge Co., $19,300. The contract was not awarded.

Cincinnati, O.—The contract for the wrought iron bridge over Millcreek on Mitchell avenue was awarded to the Brackett Bridge Co. at its bid of $6,250.

Columbus, O.—There is a movement on foot to have a bridge erected across the Scioto River at Fifth avenue. The Legislature will be asked for authority this winter to issue bonds to pay for the structure.

Hyndman, Pa.—A new bridge will have to be built at once over Wills Creek, a short distance east of Hyndman, on the Pittsburgh Division of the Baltimore & Ohio, to replace the structure wrecked on Nov. 27.

Maine Central.—The Maine Central has decided to erect new steel bridges at the following points during the coming year: Topsham bridge over the Androscoggin at Brunswick, on the main line; over the Kennebec at Waterville; Ticonic bridge over the Kennebec at Waterville, and the two west spans of Lewiston bridge over the Androscoggin at Lewiston. Topsham bridge will have four spans, length 730 ft. 5 in.; Ticonic bridge, four spans, length 628 ft.; Lewiston bridge, two spans, length 317 ft. 2 in.

Montreal, Que.—Mr. St. George, City Engineer, is preparing plans for an iron bridge over the Canadian Pacific tracks at the entrance of the Brock street tunnel.

New Bedford, Mass.—Several plans have been prepared for the proposed bridge across the Acushnet River, some of the plans providing for a wooden and others for steel superstructure, the pierwork to be of iron. The difference in cost between a wooden and steel bridge would be nearly $50,000.

Niagara Falls, Ont.—Official notice is given of an application to the Dominion Parliament for an act to incorporate the Niagara Falls Electrical Railway Bridge Co. to build a bridge across the Niagara River, at some point between the Niagara Falls and the Whirlpool Rapids. The height of the bridge above the level of the water is to be 200 ft.

Port Stanley, Ont.—J. A. Bell, C. E., has received instructions from the Council of the County of Elgin at St. Thomas, to prepare plans for rebuilding the Port Stanley Bridge. The new structure will have two spans of about 110 ft. each, built of iron or steel, with 16 ft. roadway. The contract will be awarded in December.

Scranton, Pa.—Bids have been sent in to the City Engineer, by a dozen firms for the iron viaduct on West Lackawanna Avenue between Scranton and Ninth streets. The bids range from $20,000 to $35,000. The cost of the viaduct will be borne equally by the Delaware, Lackawanna & Western Railroad Co., whose tracks it will cross with a continuous span of 125 ft., the Scranton Traction Co., and the city.

Three Sisters, Ont.—Acting under instructions of Mr. Pusey, W. B. Smellie, Civil Engineer, is preparing plans of a bridge to span the St. Lawrence River at Three Sisters, and touching the American shore west of Morristown, N. Y. Before the end of this month some of the plans will be completed and submitted to both governments for approval. The charter expires in February unless the work has begun, and very probably the present activity is simply to do just enough work to fulfill the terms of the charter.

Turner Center, Me.—The contract for the bridge across the Androscoggin near Turner Center, connecting Turner and Greene, has been awarded to the Berlin Iron Bridge Co., of East Berlin, Conn., for $7,050. It is to be 340 ft. long and will have a 16-ft. roadway. The same company is erecting a bridge across the Androscoggin at Mexico.

Woodbridge, Ont.—At a meeting of the York County Council held recently at Toronto, Ont., the Engineer recommended that immediate steps be taken to erect a new bridge at Woodbridge. The new structure is to be of steel.

Woodstock, Ont.—The municipal council is calling for tenders for the construction of a bridge on Finkle street.

MEETINGS AND ANNOUNCEMENTS.

Dividends:

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago, Burlington & Quincy, quarterly, 1¼ per cent., payable Dec. 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlantic & Pacific, annual, New York City, Dec. 14.
Columbus, Shawnee & Hocking, special, Columbus, O., Dec. 20. To consider the proposed consolidation with the Sandusky & Columbus Short Line.
Grand River Valley, special, Jackson, Mich.. Jan. 10.
Lehigh & Hudson, annual, New York City, Dec. 4.
New York & New England, special, Boston, Mass., Dec. 27.
New York, Pennsylvania & Ohio, annual, Cleveland, O., Dec. 6.
Rome, Watertown & Ogdensburg, annual, New York City, Dec. 28.
Sandusky & Columbus Short Line, special, Sandusky, O., Dec. 21. To consider the proposed consolidation with the Columbus, Shawnee & Hocking.
Ulster & Delaware, annual, Rondout, N. Y., Dec. 5.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Northwestern Track and Bridge Association* will meet at the St. Paul Union Station, on Dec. 13, at 2:30 p. m.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *Northwest Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, except June, July and August, at 8 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Tacoma Society of Civil Engineers and Architects* meets in its rooms, 201 Washington Building, Tacoma, Wash., on the third Friday in each month.

The *Association of Engineers of Virginia* holds informal meetings the third Wednesday of each month, from September to May, inclusive, at 719 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The *Western Society of Engineers* meets at 78 La Salle street, Chicago, on the first Wednesday in each month, at 8 p. m.

The *Engineers' Club of St. Louis* meets in the Odd Fellows' Building, corner Ninth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' Society of Western Pennsylvania* meets at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month at 8 p. m.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo, on the second Monday in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

Association of Engineering Societies.

Prof. J. B. Johnson, of St. Louis, has been elected President of the Association of Engineering Societies, and Mr. John C. Trautwine, Jr., of Philadelphia, has been elected Secretary of the Society to succeed Mr. J. W. Weston, of Chicago.

The Civil Engineers' Club of Cleveland.

The club met on Nov. 14, 55 members and visitors present. The tellers announced the election to active membership of the following: W. C. Jewett, A. Lincoln Hyde, Frank H. Constant, John G. Schmitt and Henry Grey.

Mr. W. H. Searles then presented a paper on the "Ferris Wheel," which was discussed by Prof. J. W. Langley, C. F. Lewis, W. R. Warner, Geo. E. Gifford, Ambrose Swasey, F. C. Osborn, A. H. Porter and N. P. Bowler.

Engineers' Club of Philadelphia.

The next meeting of the club will be held on Dec. 2, when a proposed increase of dues of resident members will come up for action. Nominations of officers for the ensuing year will be made. A paper prepared by Max Uhlmann on "Some Novelties in Bevel Gearing" will be read, and the discussion on riveting pressures required for bridge and boiler work will be continued.

This subject was discussed at the meeting on Nov. 18.

In regard to the pressure required for driving such rivets, Mr. Wilfred Lewis recalled some experiments made by William Sellers & Co., Incorporated, between the compression platforms of their testing machine. A number of ⅞-in. rivets were subjected to pressures between 10,000 and 60,000 lbs. At 10,000 lbs. the rivet swelled and filled the hole without forming a head. At 20,000 lbs. the head was formed and the plates were slightly pinched. At 30,000 lbs. the rivet was well set. At 40,000 lbs. the metal in the plate surrounding the rivet began to stretch, and the stretching became more and more apparent as the pressure was increased to 50,000 and 60,000 lbs. From these experiments the conclusion might be drawn that the pressure required for cold riveting was about 300,000 lbs. per square inch of rivet section. In regard to the pressure for hot riveting, he said that until recently, within the last decade, there was never any call for a pressure exceeding 60,000 lbs., but that now pressures as high as 150,000 lbs. were not uncommon, and even 300,000 lbs. had been contemplated as desirable.

Mr. JAMES CHRISTIE: Since critical systems of inspection and testing material have become common, the importance of having rivets solidly driven has been more thoroughly appreciated than formerly. Hand work is avoided where possible, and higher pressures are used than before Machines are preferred that will deliver the maximum pressure to the rivet with certainty. The direct hydraulic ram has the advantage of compactness, and when its fluid is stored in an accumulator there is a sudden impact or elevation of static pressure on the rivet at the termination of each stroke—a circumstance highly favorable to the riveting operation. It has been found in girder work that for red-hot rivets of iron or soft steel, with length of grip not exceeding three diameters, a pressure of 50 tons per square inch of rivet section has been sufficient to completely fill the hole. Longer rivets require higher pressure, and in extreme cases this pressure must be doubled to secure solidity. The shape of the head can be modified to a form favorable for the flow of metal into the body. The results of some experiments are submitted on the board, illustrating the advantage of high pressure on the riveted joint.

Engineers' Club of St. Louis.

A regular meeting was held on Nov. 15 at Washington University, with President Moore in the chair and 25 members present.

Messrs. Arthur L. Tuttle, E. M., and Richrad McCulloch, E. M., were elected to membership.

Ten members were nominated for a committee on nominations, from whom the following five were elected: W. H. Bryan, Carl Gayler, Wm. Bouton, Julius Baier, B. H. Colby.

SMOKE ABATEMENT.

The paper of the evening, by Prof. W. B. Potter, on "Progress of Smoke Abatement in St. Louis," was then read. Prof. Potter stated that two inspectors had been appointed, who had been busy on preliminary work for the past two months, and that prosecutions were now about to be started against offenders, for which purpose a special attorney had been secured by the Citizens' Executive Committee; that a month's notice was served on offenders after having been reported by the inspectors, after which time they would be prosecuted if they did not abate their smoke. The Smoke Prevention Committee, of which Prof. Potter is chairman, was not prepared to make a final report, as only three devices had been thoroughly tested—the Hawley down-draught, the Boileau and the zig-zag grate-bar. About fifty different devices for preventing smoke are in use in St. Louis, some of which are quite extensively and successfully used. Difficulty was found in getting accommodations for testing new devices, but that five more were to be tested next month. The steam jet principle is used in many of the devices, the down-draught in several others, and coking arches in others. So-called combustion powders or compounds, to add to coal before or during use, were being advocated, which usually consisted of about 25 per cent. of niter, with salt, sulphate or carbonate of soda, carbonate of ammonia, etc., which were supposed to improve the combustion, prevent smoke and slag the ashes; that they were valueless, as the amount of niter was too small to do any good, as only 3 lbs. of powder is used, while the trouble with our ashes is that they are too fusible already, and hence clinker on the grate-bars. The work of the committee has resulted in creating a demand for better designed boilers and greater care in operating, besides abating the smoke; care is being exercised in selecting fuels, and probably coal would soon be sold on the basis of heat units capacity in this market. The steam jet principle is usually quite effective in preventing smoke, but generally at a slightly increased consumption of fuel. A case was cited, however, where an economy of 18 per cent. had been attained with a steam jet where a bed of 15 in. was carried on a hard worked boiler, though when the thickness was increased to 20 or lessened to 8 in. there was a loss in economy and capacity. The down-draft type is not only effective in preventing smoke, but increases the efficiency and economy of the plant, and 40 to 45 lbs. of coal per square foot of grate surface, with a good draught, or 50 lbs. with strong draft, can be burned on down-draft grate-bars. The Wabash Railroad is successfully preventing smoke on its locomotives by a combination of a steam jet and a baffle arch, which latter did away with the excessive noise of the jet. A new down-draft device had been brought out in London, England, for domestic stoves and ranges that is quite successful, and which promises to solve the smoke problem from dwellings, but smokeless fuels, like coke, anthracite, oil and gas are already available, which not only prevent smoke, but are much cleaner, and that crushed coke is but little more expensive than coal.

The paper was discussed by Messrs. Brunner, Colby, Prof. Johnson, Bryan, Moore, Prof. Wheeler and Prof. Kinealy, in which Mr. Bryan stated that the extra expense of adding a down-draft device to a 100 H. P. plant was about $800, while Mr. Moore added that an economy of about 23 per cent. in fuel would thereby be saved. Prof. Potter stated that no ordinary grate-bars would satisfactorily prevent smoke, over long periods, where the care of the fireman had to be depended on, no matter how slow the rate of combustion.

New York Railroad Club.

An interesting and largely-attended meeting of the New York Railroad Club was held at 12 West Thirty-first street, New York City, on Nov. 23. The reports of the Secretary and Treasurer showed that the financial affairs of the Club are in a healthy condition, the Treasurer reporting a balance of nearly $1,000 on hand. The present membership is about 340, the increase during the year being 141 members. The following officers were re-elected: *President*, R. C. Blackall, Superintendent of Motive Power and Machinery, Delaware & Hudson Railroad; *First Vice-President*, George W. West, Superintendent of Motive Power, New York, Ontario & Western; *Second Vice-President*, A. E. Mitchell, Superintendent of Motive Power and Machinery, New York, Lake Erie & Western; *Third Vice President*, W. H. Lewis, Master Mechanic, Delaware, Lackawanna & Western; *Secretary*, John A. Hill, Editor *Locomotive Engineering*; *Treasurer*, C. A. Smith, Superintendent Union Trunk Line. The present Executive Committee was also re-elected, and Messrs. F. M. Patrick, of the H. W. Johns Manufacturing Co.; R. A. Parke, of the Westinghouse Air-Brake Co., and W. P. Coolbaugh were elected to the Finance Committee. It was decided to change the size of the pamphlet reports of the proceedings of the Club to a page 6 × 9 in., so as to make the size uniform with that of the reports of the Master Car Builders' and Master Mechanics' conventions. It is understood that the other railroad clubs will also adopt this size of page for their published proceedings.

There was an extended discussion on Mr. D. L.

Barnes' paper on the Construction and Inspection of Locomotive Boilers, which was read at the meeting of Oct. 19. Among those who spoke were A. E. Mitchell, of the New York, Lake Erie & Western; George W. West, of the New York, Ontario & Western; M. N. Forney; W. F. Dixon, of the Rogers Locomotive Works; G. R. Joughins, of the Norfolk & Southern and Angus Sinclair. Exceptions were made to many of the statements in Mr. Barnes' paper. The chief criticisms were on his rules for the inspection of boilers, many of the speakers contending that it would be entirely unnecessary to make the examinations of boilers recommended by Mr. Barnes, at the frequent intervals he proposed. The cost, it was stated, was an important element and railroads could not afford to carry out the rules. Mr. Worthington, a Mechanical Engineer with Beyer, Peacock & Co., of Manchester, England, made an interesting speech pointing out differences between locomotive practice in England and this country, especially in regard to boiler design, which he had noticed during his visit to this country. He mentioned that the fireboxes of the English locomotives were made of copper, while in America steel was used almost entirely. He believed from what he had seen in this country that steel was the better metal, and he thought that English locomotive builders would be led to see the advantages of steel over copper for fireboxes. The arrangement of stays in English locomotives he thought much better than in most of the locomotives he had seen in this country; they are placed much closer for one thing, though he had noticed some locomotives on Western roads where the stays were put in too close to be good practice.

PERSONAL.

—Mr. C. D. Morris has been appointed Assistant General Freight Agent of the Louisville, Evansville & St. Louis Railroad, with headquarters in St. Louis.

—Mr. Tilden R. Selmes, who was last week appointed Receiver for the Winona & Southwestern, has been the Attorney for the Northern Pacific for several years past.

—Mr. Charles Clement, of Rutland, Vt., a former President of the Rutland railroad, died in New York, on Nov. 26, at an advanced age. He became President of the road in 1883.

—Mr. William M. Banning, of St. Paul, who was President of the St. Paul & Lake Superior road, now part of the Northern Pacific system, between the years 1864 and 1871, died at St. Paul, Nov. 26.

—Mr. William C. Hudson, Secretary of the New York State Railroad Commission, has resigned his office, the resignation having been asked, it is said, for political reasons. The new Secretary is Mr. James D. McMahon, of Utica, Deputy Attorney General of New York. Mr. Hudson has been secretary of the Commission for ten years.

—Mr. A. W. Summer, Assistant Purchasing Agent of the Pennsylvania Railroad, has been promoted to the position of Purchasing Agent to succeed Mr. Enoch Lewis, who has held the place for many years, and recently resigned on account of age.

—Mr. George J. Parkin has been appointed Master Mechanic of the Erie and Ashtabula division of the Pennsylvania lines west of Pittsburgh, Northwest System, vice Mr. J. A. Wood, transferred. Mr. Parkin's headquarters will be at Erie, Pa.

—Mr. A. S. Grant, of Palestine, Tex ,has been appointed Master Mechanic of the Houston East & West Texas Railroad, where with headquarters at Houston for many years he has been General Foreman of the International & Great Northern bridge and building department at Palestine.

—Mr. Theodore Voorhees, who has been Acting General Manager of the Lehigh Valley Railroad since the lease of that road to the Philadelphia & Reading was abrogated in August, has been given the full title of General Manager by an order issued by President Wilbur under date of Nov. 27.

—Mr. S. B. Morse, Assistant General Passenger Agent of the Louisville & Nashville road, has accepted the position of General Eastern Agent of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Buffalo. Mr. Morse was for many years General Passenger Agent for the Kentucky Central.

—Mr. Paul S. King, who was Chief Engineer of the Lehigh Valley extension to Buffalo, has returned to the service of the company, and his headquarters for the present will be at New York. Mr. King resigned early in the summer, when the construction work had been completed, and went to Europe for rest.

—Mr. E. H. Trowbridge, one of the oldest directors of the New York, New Haven & Hartford, and Chairman of its Finance Committee, died at New Haven, Conn., on Nov. 24. Mr. Trowbridge had been Vice-President of the Shore Line Railroad before it became part of the New York, New Haven & Hartford system, and his connection with the company covered a period of nearly 20 years.

—Mr. W. A. Garrett has been appointed Superintendent of the Terminal Railroad Association of St. Louis. He has been Acting Superintendent of Transportation for the past year. The office of General Superintendent of the company, which has been vacant for some time, has been formally abolished, the present General Manager, Mr. Joseph Ramsey, Jr., assuming all the duties of the position.

—Mr. T. B. Lynch has been appointed Acting General Passenger Agent of the Chesapeake, Ohio & Southwestern, with headquarters at Louisville, and Mr. F. C. Dunbeck has been appointed Acting General Freight Agent, these appointments dating from Nov. 22, when the resignation of Mr. L. F. Day as Traffic Manager went into effect. Mr. Day has been elected Chairman of the Southwestern Traffic Association.

—Col. L. L. Bush, a well known railroad contractor in Pennsylvania, where he had built some important lines, died at his home at Bird-in-Hand, Pa., on Nov. 24. The Lancaster & Reading narrow gage, the Gettysburg & Harrisburg, the Downingtown & New Holland, the Schuylkill Valley, the Philadelphia & Newtown, the West Penn branch of the Pennsylvania Railroad, were among the Pennsylvania roads he built or on which he had large contracts. He was President of the Pennsylvania Construction Co., which built the Kansas City, Fort Smith & Southern.

—Mr. C. A. Higgins has been appointed Assistant General Passenger Agent of the Atchison, Topeka & Santa Fe, with headquarters at Chicago. Mr. Higgins has been connected with the Santa Fe for the past 12 years and his appointment is in deserved recognition of past services. He was formerly clerk to the Board of Directors at Boston and went to Chicago in 1889, since which time he has been Chief Clerk to Passenger Traffic Manager White. He is the author of several interesting and handsome brochures descriptive of the scenic and historic attractions of the Santa Fe route.

—Mr. Isaac D. Barton, who became General Superintendent of the New York & New England in January, 1892, when Mr. Corbin was President of the road, has resigned this week. It is announced that the office will be abolished and that the duties of the position will be assumed by the Vice-President, Mr. J. T. Odell. Mr. Barton before going to the New England line was General Superintendent of the Long Island road, a position which he had held for over ten years. He had previously been Manager of the Manhattan Beach and other Long Island roads, as well as of a Western line with which Mr. Corbin has been identified.

—Mr. R. W. Bryan, Assistant General Superintendent of the Eastern Division of the Great Northern, has been appointed General Superintendent of the same road to succeed Mr. C. W. Case, appointed General Manager. Mr. Bryan came to the Great Northern 12 years ago as Train Dispatcher and, since that time, his advancement has been continuous. He has occupied consecutively the position of Chief Train Dispatcher, Assistant Division Superintendent, Division Superintendent and Assistant General Superintendent. Prior to his connection with the Great Northern he was for 10 years in the service of the Chicago, Burlington & Quincy.

—Mr. Stephen Wilcox, Vice-President of the Babcock & Wilcox Company, died at Brooklyn, N. Y., on Nov. 27, of pneumonia, aged 63 years. Mr. Wilcox had been Vice-President of the Babcock & Wilcox company since its organization, in 1881, and previous to that he had been a member of the firm of Babcock & Wilcox, which it succeeded. Mr. Wilcox's career has been an exceedingly honorable one, and his work in the development of water tube boilers had been most important. He had been engaged in the manufacture of boilers since 1856, and was the first person to use inclined water tubes connecting water spaces front and rear with a steam space above.

—Mr. Soloman S. Guthrie, who was connected for more than 40 years with the commercial interests of Buffalo, died in that city last week, age 74 years. Mr. Guthrie's business interests were chiefly in mercantile life, but he was for a time President of the Union Steamboat and the Union Dry Dock companies at Buffalo. He was also at one time a director of the New York, Lake Erie & Western, and in 1874 was appointed General Agent of that road at Buffalo by Mr. H. J. Jewett, then Receiver of the company, and a brother-in law of Mr. Guthrie. Mr. Edward B. Guthrie, who is connected with the Bureau of Engineering of the city of Buffalo, is one of his sons.

—Mr. James Hamilton, who died in Chicago on Nov. 19, was an engineer identified in a prominent way with the early railroad interests of the city of Chicago. He had retired from active business 15 years ago, and was 69 years old at his death. He was born in England, but came to this country in early life, and immediately went into engineering work. He removed to Chicago in 1847, and was engaged on the surveys of many of the roads leading into the city. He was Assistant Engineer of the Illinois Central, the Northwestern, and had held responsible positions on other Western lines. He was employed on the Panama Railroad in the years 1850 and 1851 on surveys and the early construction work on that line.

—Mr. J. D. Campbell, Assistant Superintendent of Motive Power on the New York Central & Hudson River road, has resigned. He was appointed to the position in January, 1891, having previously been connected with the Manhattan (Elevated) of New York for three years as Superintendent of Transportation. Hereafter there will be two Assistant Superintendents of Motive Power, the road being divided into two divisions at Syracuse for the better administration of the Mechanical Department. Mr. George H. Hazleton, who has been Master Mechanic of the Rome, Watertown & Ogdensburg, will have jurisdiction of the division west of Syracuse; and Mr. James Buchanan, who has been Master Mechanic of the West Albany shops and is a brother of Mr. William Buchanan, has been appointed Assistant Superintendent of Motive Power in charge of the division east of Syracuse. Mr. P. T. Lonigan becomes Master Mechanic of the Rome, Watertown & Ogdensburg.

—Mr. Thomas M. Cleemann, a well-known Philadelphia engineer, and author of a book on Railroad Engineers' Practice, published in 1880, died at Guayaquil, Equador, S. A., on Nov. 16. He went to Equador last summer as a consulting engineer of the water works at Equador. A good part of his work as engineer had been carried out in South American countries. In 1871 he went to Peru to supervise the erection of the first Verragus viaduct, but he was attacked by fever and was unable to work on the bridge. He remained in Peru, however, as Division Engineer of the Callao, Lima & Oroya Railroad. He returned from Peru in 1874, but in 1876 again went to South America as Engineer of the Southern Railroad of Chili. Mr. Cleemann was Principal Assistant Engineer of the main building of the Centennial Exposition, and for some years was Assistant Engineer of the Philadelphia Water Department. In 1880 he became Resident Engineer of the Richmond & Allegheny Railroad, and in late years has been engaged as a Consulting Engineer in Philadelphia. Mr. Cleemann was a member of the American Society of Civil Engineers and for one term was President of the Engineers' Club of Philadelphia. In 1892 he delivered a course of lectures on Railroad Engineering at the Rensselaer Polytechnic Institute, at Troy, of which he was a graduate.

—Mr. C. W. Case, General Superintendent of the Great Northern, has been appointed General Manager of the same road to succeed Mr. A. L. Mohler. Mr. Case entered the railroad service as brakeman on the Milwaukee & Mississippi in 1851. In November of the same year he changed to the engine service, and two years later was "set up" on the Milwaukee & Watertown. He continued as a locomotive engineer from 1855 to 1865, when he was appointed Agent for the Winona & St. Peter, at Rochester, Minn. He served as Agent for this road and the Chicago, Milwaukee & St. Paul at various points until 1867, when he was appointed freight and ticket agent for the latter company at Minneapolis, continuing in that position for nine years. From 1876 to 1882 he was Assistant Superintendent of two divisions of the road; and from 1883 to 1886 was Division Superintendent and for the next two years Assistant General Superintendent. On Oct. 1, 1888, he resigned the latter position to accept that of General Superintendent of the St. Paul, Minneapolis & Omaha, now the Great Northern, and has continued in that capacity until promoted to the office he now assumes.

—Mr. A. L. Mohler, General Manager of the Great Northern, has resigned that position on account of his health and will spend the winter in North Carolina. Mr. Mohler has held the position of General Manager since Oct. 10, 1888, when he succeeded to the late Allen Manvel, who had been elected President of the Atchison, Topeka & Santa Fe. Mr. Mohler entered the railroad service in 1868, when 19 years of age, as warehouse and office clerk of the Chicago & Northwestern at Galt, Ill. After serving two years in that capacity he was Station Agent for the Rockford & East St. Louis, and later clerk in charge of operating account in the Auditor's office of the same road. In 1871 he entered the service of the Burlington, Cedar Rapids & Minnesota, now the Burlington, Cedar Rapids & Northern, as Traveling Auditor and Pioneer Agent, serving in that capacity for two years, when he entered the freight department as Chief Clerk. At the end of his second year in that position he received the appointment of Assistant General Freight Agent, and one year afterward was promoted to the position of General Freight Agent. He continued in the latter position for six years, and on Oct. 9, 1882, ended his 11 years connection with the road by resigning to accept the position of General Freight Agent of the St. Paul, Minneapolis & Manitoba. In March, 1886, he was appointed Land Commissioner, and in January, the following year, resumed the position of General Freight Agent. In April, 1888, he was promoted to be General Superintendent of the road, and on Oct. 10 of the same year was elected General Manager. He was confirmed in that position when the road practically became the Great Northern, and his jurisdiction was extended over the Montana Central and other proprietary lines. During the 11 years he has been connected with the Great Northern system its lines have been extended in every direction, and, from a road reaching only the wheatfields of Minnesota and the Dakotas, it has grown until it now extends from the Great Lakes to the Pacific Ocean.

During the quarter of a century Mr. Mohler has been engaged in the railroad service his career has been unblemished and his record is one to be proud of. His departure from the Northwest, although it may only be temporary, is sincerely regretted by the people of that locality.

ELECTIONS AND APPOINTMENTS.

Catskill & Tannersville.—At the annual meeting held at 54 Harrison street, New York City, the following directors were elected: Charles L. Rickerson, A. Van Santvoord, George M. Snyder, Isaac Pruyn, Jacob Fromer, N. D. Baldwin, James Stear, H. W. Ritter and C. C. Hayer.

Central Pacific.—William H. Mills, General Land Agent of the company, has been elected a director, to succeed H. A. Cummings, deceased.

Chesapeake & Ohio.—At the annual meeting of the company at Richmond, Va., Chauncey M. Depew was elected to succeed C. P. Huntington on the Board of Directors.

Cincinnati, Dayton & Chicago.—W. W. Hearing has been appointed Superintendent of the Division to succeed J. E. Gimperling, resigned. This road, though part of the Cincinnati, Hamilton & Dayton system, is operated distinct from the other lines of that company.

Cleveland, Lorain & Wheeling.—The consolidation of this road with the Cleveland & Southwestern has been effected and M. D. Woodford, Eugene Zimmerman, Alfred Sully, Henry A. Taylor, John B. Dennis, John Newell, E. B. Thomas, James A. Blair, W. R. Woodford, W. A. Shoemaker, D. P. Eells, L. A. Russell and J. Walter McClymonds were elected directors. M. D. Woodford was elected President; John B. Dennis, Vice-President; W. A. Shoemaker, Secretary, and H. F. Sanford, Treasurer. W. R. Woodford continues as General Manager. The only change in the title of the company is the substitution of railway for railroad.

Florida Central & Peninsular.—J. L. Adams has been appointed General Eastern agent, with headquarters at 353 Broadway, New York City. The new office at this location has just been opened. Mr. Adams was formerly Chief Clerk of the passenger department of the Savannah, Florida & Western and Chief Clerk of the passenger department of the Richmond & Danville, and at the time of his present appointment was agent of the passenger department of the Trunk Line Association.

Litchfield, Carrollton & Western.—E. W. Clifford, of Carlinville, Ill., has been appointed Superintendent of this road, which has heretofore been operated as a part of the Jacksonville Southeastern system, but has recently been transferred by the Receivers of that line to the local stockholders, by direction of the United States Court. The road is 50 miles long from Barnett to Columbiana, Ill.

Georges Valley.—The directors of the road held a meeting in Rockland, Me., on Nov. 22, at which the following officers were chosen: W. W. Case, President, and James Mitchell, General Manager. The new Board of Directors for the ensuing year are W. W. Case, James Mitchell, W. T. Coff, F. A. Crockett, S. M. Bird, of Rockland, and S. C. Thurston and F. A. Alden, of Union.

Great Northern.—The following changes are announced, effective Dec. 1.: A. L. Mohler having resigned, C. W. Case is appointed to succeed him as General Manager; R. W. Bryan, Assistant General Superintendent of the Eastern Division is appointed General Superintendent to succeed Mr. Case.

Gulf, Beaumont & Kansas City.—S. A. McNeely has been appointed General Superintendent, and Mark Weiss General Passenger Agent, of this road, now building in Texas.

Hearne & Brazos Valley.—The following are the present officers of this company, operating a 20-mile road in Texas: R. J. White, of St. Louis, President; L. W. Carr, of Hearne, Tex., Vice-President; Edward Wilson, of Austin, Tex., General Manager; William Kerlicks, of Hearne, Treasurer and Auditor.

Lehigh Valley.—Theodore Voorhees has been appointed General Manager of this company, with offices at the general office of the company, 228 South Third street, Philadelphia, Pa.

New York Central & Hudson River.—Geo. H. Haselton has been appointed Assistant Superintendent of Motive Power in charge of divisions west of Syracuse, N. Y., vice J. D. Campbell, resigned; James Buchanan has been appointed Assistant Superintendent of Motive Power in charge of divisions east of Syracuse; P. T. Lonergan has been appointed Master Mechanic of the Rome, Watertown & Ogdensburg, vice George H. Haselton.

New York, Lake Erie & Western.—At a meeting of the directors in New York, on Nov. 22, the board of 1893 were re-elected. They are: John King, John G. McCullough, Ogden Mills, J. Lowber Welsh, Abram S. Hewitt, William Whitenight, William A. Wheelock, Alexander E. Orr, Henry H. Cook, Morris K. Jessup, George W. Quintard, William Libbey, Corlandt Parker, James J. Goodin, William L. Strong, William N. Gilchrist, E. B. Thomas.

Northern Pacific.—F. M. Dudley, General Land Attorney, has been appointed Acting Land Commissioner to serve during the leave of absence, on account of sickness, of C. B. Lamborn, Land Commissioner. C. T. Noonan has been appointed Soliciting Freight Agent at Milwaukee.

Parkersburg Branch.—The annual meeting of the stockholders of this road, which is operated by the Baltimore & Ohio, was held at Parkersburg, W. Va., on Nov. 27. Orland Smith was elected President, with these directors: Robert Garrett, W. F. Barus, W. W. Taylor, W. H. Blackford and Aubrey Pearre, of Baltimore; C. H. Shattuck, J. N. Camden and W. N. Chancellor, Parkersburg; D. C. Winesbrener, Frederick, Md.; Thomas S. Spates, Clarksburg, W. Va.

Seaboard Air Line.—The traffic department of the Seaboard Air Line has been removed to the company's general office in Portsmouth, Va.

Sugar Land.—This road is now being operated by the following officers: E. H. Cunningham, President; G. B. Miller, Vice-President and General Manager; Haywood Brahan, Secretary and Treasurer, and W. K. Morrow, Traffic Manager. The address of all the officers is Sugar Land, Tex.

Terminal Railroad Association of St. Louis.—W. A Garrett has been appointed Superintendent, and will report direct to the General Manager, J. Ramsey, Jr.

Vandalia Line.—Victor K. Hendricks has been appointed Assistant Engineer of the Logansport and Peoria divisions.

Wilmington & Weldon.—The annual meeting was held at Wilmington, N. C., on Nov. 22, and the following directors were elected: W. T. Walters, Michael Jenkins, H. B. Plant, B. F. Newcomer, J. P. McCay, A. J. de Rosset, H. Walters, E. B. Borden, George Howard and W. H. Willard. The directors elected the following officers: President, Warren G. Elliott; Vice-President, H. Walters; Secretary and Treasurer, James F. Post, Jr.; General Manager, John R. Kenly; Traffic Manager, T. M. Emerson; General Auditor, W. A. Riach, and General Superintendent, John F. Divine.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Baltimore Belt.—The contract for laying rails for the Belt railroad has been awarded to the Drake & Stratton Co., of New York, and the Pencoyd Bridge Company will construct the bridges at the street crossings in Baltimore.

Bangor & Portland.—It is now stated that the early extension of the line from Nazareth to Allentown is more than a possibility. The original plan was to build this road from Portland to Allentown, thus connecting the Delaware and Lehigh rivers. John J. Heintzelman is Superintendent.

Central of Pennsylvania.—It has been decided to open this line for general traffic on Dec. 4. The road was erroneously referred to last week as the Bellefontaine Central, which is a distinct corporation. The line now completed is 26 miles long from Bellefontaine to Mill Hall, Pa., extending through Nittany Valley, which is a well-cultivated valley and has important deposits of iron, and there are important industries at Bellefonte. The freight traffic from these sources, as well as from carrying lumber, is expected to furnish a large freight traffic from the first. The road connects at Bellefontaine with the Pennsylvania, of which it will be in some sense a competitor, and connection is made at Mill Hall with the Beech Creek road.

Actual construction work was commenced on the line between Bellefonte and Mill Hall, on May 16, 1893, under the immediate supervision of J. W. Gephart, of Bellefonte, Superintendent of Construction. The grading and tracklaying was pushed under the direction of J. I. Higbee, of Watsontown, from both ends, and the through connection was made Nov. 22. The average grade does not exceed one per cent, although, in getting out of Bellefonte, on one or two short stretches, the grade is between 80 and 90 ft. to the mile. There are 17 iron bridges on the line, varying in length from 25 ft. to 120 ft. The two largest are at Clintondale and Washington Furnace, each 120 ft. in length. Another, 100 ft. in length, is two miles east of Clintondale, and another between Mackeyville and Cedar Springs is 110 ft. in length. The largest single span is 66 ft. in the clear. All these are iron girder bridges and have been constructed by the Phœnix Bridge Co. The rail used is a 70-lb. standard section. The road will be equipped with six locomotives, three of which have recently been purchased from the Schenectady Locomotive Works. The passenger equipment purchased consists of five passenger cars and one baggage, mail and express car, purchased new from the Harlan & Hollingsworth Company, of Wilmington, Del. It is expected to start passenger travel Dec. 4, and before the close of the month to complete the stations and all construction work.

Duluth & Winnipeg.—A contract let last week for building a line to the Diamond mine in Minnesota, 18 miles, has been rescinded, but the line may be begun later. The construction work will be done by the owners of the mine, and not by the railroad company.

Florence, Cripple Creek & State Line.—D. H. Moffat returned to Denver last week from New York, but stated that no definite plans had been arranged for the construction of the proposed line. He said that the Eastern people are still doubtful of the revival of business in Colorado and of the permanency of the new gold camp of Cripple Creek. However, it is believed that the line will be built as projected, from Florence, Col., to Cripple Creek.

Florida Central & Peninsular.—The local reports of the progress of the construction work on the Savannah extension state that all the track is now laid with the exception of about 17 miles on the northern end near the Altamaha River. This gap ought to be closed before Dec. 15, and the Southern Supply Company, of Atlanta, which has the contract, does not expect that the work will be delayed beyond that date. The extension is about 115 miles long and all the work has been done this year.

Georges Valley.—The road has been formally accepted by the Maine Railroad Commissioners, and will be opened to the public on Dec. 1. It is eight miles long, extending from Warren north to Union, Me. James Mitchell is General Manager.

Jacksonville, St. Augustine & Indian River.—An additional 20 miles of the extension being built to Lake Worth, Fla., has been opened for traffic, bringing the terminus of the operated road to Sebastian, opening six new stations south of Melbourne. The rails have been laid about 10 miles south of Sebastian. West Palm Beach, on Lake Worth, which is to be the terminus of the line, is about 70 miles south of the present end of track.

Kansas City, Pittsburgh & Gulf.—The tracklaying on the extension to Siloam Springs, Ark., is only now being finished, although it was expected to have the rails laid to that point the first part of October. The line now building is 25 miles long and begins at Siloam Springs, the former terminus of the Kansas City, Fort Smith & Southern, which is now owned by the above company. Siloam Springs is on the direct line to Fort Smith, which will be the objective point of next year's construction work.

Kingfield & Dead River.—The contractors have now finished all the grading on this road on the 10 miles north of Kingfield, Me.; the stone masonry is also about finished and the iron bridges will soon be erected. The tracklaying began this week at Kingfield, and it is expected to lay the first five miles by Dec. 10. The terminus of the road will be at Drew's Mills, five miles farther north. McGregor Brothers, of Rumford Falls, are the contractors. The road is built on the west side of the Carrabasset River, for four miles, and crosses with two 70-ft. iron spans. It then follows along on the east side for the remaining 5½ miles to Drew's mill in Jerusalem township.

Kings River.—The charter of this company was issued in Arkansas last week. The incorporators are H. M. Coulter and A. P. Moore, St. Louis; R. J. Wilson, Fayetteville, Ark.; B. R. Davidson and T. M. Gunter, of Fayetteville, Ark. The route begins at a point on the St. Paul branch of the St. Louis & San Francisco near the town of Baldwin, thence eastwardly through the counties of Washington and Madison to Kingston, in Madison county, a distance of about 38 miles. A short branch about 30 miles in length is to be built from Cazadero, a point on this line, southwest, for the purpose of obtaining wood from the Jazmin Mountains. It will be built by private parties, and this company is to have no ownership in it, though it may operate the line when completed.

Midland Terminal.—The contract of Clough & Davidson referred to last week is for the grading into Cripple Creek from Midland, Col., to which the road has been already graded from Divide Station, on the Colorado Midland. Work has begnn in the canon on heavy rock work. All materials are on the ground and the work will be pushed with considerable vigor. The rails are now being laid from Divide on the graded section. The line will be partly opened for business in the first week of December.

Mississippi & Leech Lake.—Chief Engineer H. A. Rider has completed the preliminary survey of the proposed line from Little Falls, southwest to St. Cloud, Minn., on the Grand Trunk, 30 miles. The town of Hollingsford offers a bonus of $10,000 for the road, and the town of Avon one of $6,000. C. A. Weyerhauser is Vice-President of the new company and Drew Musser is Secretary. The headquarters of the company is at Little Falls.

Montana Southern.—This line is surveyed from Helena, Mont., east to Cañon Ferry at the Missouri River and from Whitehall to Laurin. The grading is nearly completed from Helena to Cañon Ferry, and from Whitehall 20 miles south. No track will be laid until next spring. The present contractors for grading are Brady & Davidson, of Helena. Wooden bridges will be built at the two crossings of the Missouri River and one across the Jefferson River. The route of the road is from Helena, Mont., east to Cañon Ferry, and southeast via Townsend, Tosten, Whitehall, Twin Bridges, Sheridan, Laurin, to coalfields on the upper Ruby River, with branches from Laurin to Virginia City, Mont., and from Twin Bridges to Dillon. The proposed line opens up a rich mineral, agricultural and coal region in Montana which offers a very large tonnage at once. Arrangements are under way by which it is expected to push the work rapidly next spring to the coal mines. The officers of the company are: Samuel Word, President, and R. A. Harlow, Vice-President, of Helena, Mont.; H. Elling, Treasurer, Virginia City, Mont.; S. M. Kielland, Chief Engineer, of Helena.

Nakusp & Slocan.—Some eight miles of rails have been laid from Nakusp, B. C., eastward, and grading has been completed much farther. Work will be resumed at the earliest possible date in spring, so as to have trains running into the heart of the Slocan mining district not later than June. Some 1,200 men have been engaged on the work.

Nelson & Fort Sheppard.—This extension of the Spokane Falls & Northern, which has been under construction this summer, is rapidly nearing completion. The work remaining to be done consists of building two bridges and about five days, tracklaying. The line will not be built into Nelson, B. C., until next spring, and the winter terminus will be five miles from that point. The first train over the line will be run this week from Northport, Wash., the southern terminus, where connection is made with the Spokane Falls & Northern.

Nevada Southern.—The contract has been recently let for the extension of this road to Good Springs. It is now in operation from Blake Station, (formerly Goffs), Cal. on the Atlantic & Pacific, to Manvel Station, on the summit, about three miles south of Vanderbilt, a new gold camp in California. Besides this, eight miles has been graded, carrying the road from Manvel Station to Dry Lake Valley, beyond Vanderbilt. This grading passes directly through the mining camp of Vanderbilt, where a number of large gold mines are in operation. All this track is in San Bernardino County, California. The extension of the road now under contract is from Manvel to Good Springs, situated in the Yellow Pine Mining District, a distance of 42 miles. Besides this, the preliminary survey of a further extension to Cedar City, in Iron County, Utah, by way of Las Vegas, Moapa, Valley of the Muddy and Virgin, St. George and Kanarra, has been made, with a branch to Pioche. A feasible line has been found which will necessitate not over 10 degs. curvature nor over 3 per cent. maximum grade. The Los Angeles Chamber of Commerce is obtaining a popular subscription in Los Angeles to the bonds, to raise money to enable the road to be immediately constructed to Good Springs. Already considerable ore is being shipped by the new mining camps along the line, which has heretofore been inaccessible except by long wagon haul. Several important gold camps are being developed. The road will also open up several fine agricultural valleys which are at present but little populated or cultivated. Coal has been found at Moapa in a range close to the projected extension of this road. The importance of this discovery to Los Angeles and other southern California towns, if present reports are confirmed by some thorough investigations, will be of the utmost importance.

New Hamburgh & Poughkeepsie Connecting.—The New York State Board of Railroad Commissioners has denied the application of the company for permission to construct a standard gage steam road from New Hamburgh to Wappinger's Falls and from there to Poughkeepsie, N. Y., on the ground that public convenience and necessity do not require the construction of the road.

New Orleans & Northwestern.—Bagnell & Johnson have the contract for extending this line from Rayville northwest to Collins, La., 18 miles. The firm is composed of Robert Bagnell, of St. Louis, and R. T. Johnson, of St. Elmo, Ill.

New York, New Haven & Hartford.—The progress made during the year in extending the second and fourth tracks, and the present condition of these improvements, are summarized in the following account published in a daily newspaper, but which is evidently based upon authoritative information: All the sections which have been four-tracked have been stone ballasted. Between New York and New Haven the 12 miles between the Grand Central Station and Woodlawn belong to the New York Central, and its four tracks are finished. From Woodlawn to New Rochelle Junction, about 4½ miles, the four-tracking is in progress and will be done in about a year. From New Rochelle Junction to Port Chester, about nine miles, the four tracks are complete and in use. From Port Chester to South Norwalk, about 16 miles, the work is in progress. There is here some exceedingly heavy work, which, with obstacles in acquiring real estate, may delay the four tracks for two years. From South Norwalk to the West Bridgeport city line, about 13 miles, the four tracks are finished and in use. From Bridgeport to New Haven the work is in progress, and will probably be finished in about a year. Between these two cities is the large Woodmount cut off, which will save a distance of 1,000 ft., besides a heavy grade and curve. The four-tracking is complicated, and delayed by the large cost and trouble of acquiring right of way through Stamford, South Norwalk and Bridgeport, especially the latter city, where the expense will be very large indeed. Little has been done thus far in those branches of the work. The new loop just east of New Haven will probably not be done until next June. This new location involves a long and heavy fill, now almost done, across the Quinnipiack Meadows and a deep cut and tunnel through the East Haven hill, the tunnel to be some 700 ft. long. The cost of the grading alone will be $600,000 for a distance of about three miles, and to that cost must be added bridges and rails. The road by the new loop is lengthened about three-quarters of a mile, but this is gained by straightening other parts of the Shore Line between New Haven and New London. Fourteen grade crossings in the city of New Haven, some of them very dangerous, will be eliminated by the new loop. When it is completed the old roadbed through Fair Haven is likely to be abandoned for railroad purposes.

Ottawa, Arnprior & Parry Sound.—This road will be completed as far as Eganville, Ont., this week. Next summer the company will continue the road toward Barrie's Bay, a distance of 200 miles from Ottawa, and it is expected to complete a considerable section during the year.

Pittsburgh, McKeesport & Youghiogheny.—The Elwell Run branch opened for use Nov. 27. It extends from Whitsell, Pa., on the Youghiogheny River, five miles to coal mines and coke works. The road passes through Perryopolis and up Washington Run.

Roanoke Construction Co.—This company has been organized at Roanoke, Va., to connect with the Baltimore & Ohio or the Chesapeake & Ohio, in Botetourt County, about 30 miles from Roanoke. The officers elected are: President, R. H. Woodrum, of Roanoke; Vice-President, J. F. Effinger, of Staunton; Secretary and Treasurer, J. W. Cook, of Roanoke. President Woodrum says that the company expects that the business men will subscribe largely to the stock, and local subsidies will be asked.

San Pete Valley.—The tracklaying on the extension south of Ephraim, Utah, is now going on, the work having been commenced last week. The rails to complete the line to Manti, which is as far as the road will be built at present, have been delivered, and the eight miles to that town will be ready for operation probably the first week of December. The track was laid between Nephi and Ephraim, 10 miles, early in the summer, and the grading was finished at the same time to Manti.

South Jersey.—E. A. Tennis, of Thompsontown, Pa., who has the contract for the Cape May branch, has, it is reported, arranged to commence the construction of the branch from Tuckahoe to Cape May this week, and the road will be ready for an early summer opening. The heaviest grading yet to be done is at Woodbine and Cape May Court House. At these points the road will pass under the West Jersey tracks.

Terre Haute, Olney & Chester.—Articles of incorporation of the company were filed with the Secretary of State at Springfield, Ill., on Nov. 23. The object is to build a road from a point on the Wabash River in Clark County through Clark, Crawford, Jasper, Richland, Clay, Wayne, Marion and Jefferson counties, to Chester, near the Mississippi River. The principal office is to be at Olney. The incorporators are: T. A. Fritchey, F. N. Boyer, John M. Homer, Charles Perriman, Edmund C. Baughman, Robert N. Stetler and James E. Wharf.

Tivoli Hollow.—This road, whose chief purpose is to give the New York Central a connecting track through the city of Albany, N. Y., to the new bonded warehouses on the river front, was completed on Nov. 25. It is 1¼ miles long and has been built from the junction with the New York Central & Hudson River, in the city, to the Delaware & Hudsen track and the new warehouses on the river front. Walter Melius, of Albany, was the engineer in charge.

Tuscarora Valley.—It is now reported that the company has abandoned the idea of extending its line from East Waterford, Juniata County, to Dry Run, Franklin County, coming to the conclusion that there is not enough business for two competing lines. The Path Valley road is now building to that town.

Wheeling Bridge & Terminal.—The construction work on the branch to Benwood, W. Va., was resumed this week under the direction of the Receiver, who has secured the authority of the court to complete the work and to issue $50,000 of Receiver's certificates for the purpose. The work which now remains to be completed is 2½ miles long. The new line will secure to the company an important traffic from the mills and iron industries at Benwood. The location is along the Ohio River front for most of the distance.

Wiscasset & Quebec.—The town of China, Me., has voted to subscribe $15,000 in aid of the project. This is the first town along the route to take action in the matter. The projectors apparently rely upon securing the greater part of the necessary capital for constructing the line through township subsidies. The line as proposed will be 50 miles long, beginning at Wiscasset, Me., and extending north.

GENERAL RAILROAD NEWS.

Central of New Jersey.—The following comparative statement of earnings and expenses gives the results of operations on all the rail lines of this company for October:

	1893.	1892.	Inc. or dec.
Gross earnings	$603,080	$614,480	D. $11,400
Oper. expenses	358,463	473,264	D. 114,801
Net earn.	$244,616	$141,216	I. $103,400

Delaware River & Lancaster.—The Wilmington & Northern road, which has been operating this line since July last, has decided to surrender the temporary lease on Dec. 1. The road is about 15 miles long between French Creek Junction near Phœnixville and St. Peters, Pa., and was built in 1891. Austin Gallagher, of 15 Wall street, New York, is Vice-President and Executive officer of the company.

Elgin, Peticodiac & Havelock.—Notice is given of an application to the Dominion Parliament on behalf of C. E. Baring Young, purchaser of this road, in New Brunswick, for an act to incorporate a new company, called the Elgin & Havelock, with power to purchase and to operate the above road.

European & North American.—At the annual meeting of the company last week it was voted to issue jointly with the Maine Central bonds to the amount of $1,000,000, secured by a mortgage of the road from Bangor to Winn, the proceeds to be used for the purpose of taking up the $1,000,000 loan guaranteed by the city of Bangor, due on Jan. 1, 1893, which will be canceled.

Lake Erie, Alliance & Southern.—Suit has been brought at Alliance, O., for the appointment of a receiver for this road. The Central Trust Co., of New York City, makes the application as the trustee of $486,000 of mortgage bonds which are in default for interest since 1888. It is claimed by the trust company that the railroad is insolvent and that a receiver is necessary to protect the creditors. The line is a coal road 36 miles long, extending from Bergholz, Jefferson County, to Alliance, Stark County, O.

Lake Shore & Michigan Southern.—The earnings for the nine months ending Sept. 30, were as follows:

	1893.	1892	Inc. or dec.
Gross earn.	$17,881,159	$16,305,910	I. $1,575,249
Oper. exp	12,380,105	11,072,021	I. 1,308,084
Net earn.	$5,501,054	$5,233,889	I. $267,165
Other income	355,558	366,818	D. 11,230
Total income	$5,856,612	$5,600,707	I. $255,935
Fixed charges	3,325,588	3,270,318	I. 55,270
Surplus.	$2,531,024	$2,330,389	I. $200,665

The surplus is equal to 5.06 per cent. on the stock, against 4.67 per cent. for the corresponding period of last year.

New York & Northern.—The suit brought by the Farmers' Loan & Trust Co., as trustee, to foreclose the second mortgage of $3,200,000, has been decided in favor of the plaintiff by Judge Dykman of the New York Supreme Court, before whom the suit was argued last week. This gives the New York Central & Hudson River road, the majority holders of the stock and first mortgage bonds, full power to reorganize the property as proposed. The second mortgage bonds are in default, but the minority security holders, who opposed the suit, declared that the company had earned sufficient to pay this interest. Their contention was given in some detail last week. It is declared that the suit will be appealed.

Ohio Southern.—First mortgage six per cent. bonds of this company amounting to $1,132,000, issued to pay for the construction of the Lima extension, have just been listed on the New York Stock Exchange. These bonds are part of an issue amounting to $4,000,000, of which $2,100,000 have been previously listed. The balance will be issued at the rate of $15,000 a mile. President G. W. Saul, in making the application, gives interesting information about the new extension, which we summarize. The extension is from the city of Springfield to the city of Lima, O., a distance of about 67 miles, and the company has also built a line from its southern terminus at Wellston, a distance of 9¼ miles, aggregating about 76¼ miles. The principal object of the extension from Springfield to Lima was to obtain an outlet for the company's large and increasing coal traffic. At Springfield the road has been entirely dependent upon one connection, whereas, by the completion of this extension, connection is made with seven other lines. The road has been built in a thoroughly first-class manner, and is laid with 60-lb. rails. This company is also constructing, and will have completed in the near future, a line through the city of Lima, and a branch from Wellston to Hawks, both aggregating 15 miles. The earnings of the company for years ending June 30, 1892 and 1893, were as follows: Net (1892) $303,573.17; (1893), $400,438.42.

Old Colony.—The new stock of this company is always sold at auction and a lot of 3,000 shares which was disposed of by the company in this way in Boston last week was sold for $175 a share, netting the company about $525,000, or a premium of $225,000.

The stockholders of the Old Colony Steamship Line met at Boston last week and authorized the issue of $500,000 of 10-year five per cent. bonds, to be used to complete the payments on the new steamer to be launched next June, and which will cost $1,250,000.

Pennsylvania.—The statement of the business of all lines east of Pittsburgh and Erie for October, 1893, as compared with the same month in 1892, shows a decrease in gross earnings of $810,607, a decrease in expenses of $585,018, a decrease in net earnings of $225,589. The 10 months of 1893, as compared with the same period of 1892, show a decrease in gross earnings of $1,105,412, a decrease in expenses of $474,899, a decrease in net earnings of $630,513. All lines west of Pittsburgh and Erie for October, 1893, as compared with the same month in 1892, show a decrease in gross earnings of $666,876, a decrease in expenses of $150,252, a decrease in net earnings of $516,623. The 10 months of 1893, as compared with the same period of 1892, show a decrease in gross earnings of $921,046, a decrease in expenses of $181,026, a decrease in net earnings of $740,020.

Pennsylvania Co.—The company has sold to Kuhn, Loeb & Co. and Speyer & Co., New York, $4,000,000 Pittsburgh, Cincinnati, Chicago & St. Louis 4½ per cent. consolidated bonds. These bonds are part of a total issue of $10,000,000 bonds, of which $8,000,000 (including the above amount) have been sold to the above firms. The above issue is not a new loan, but part of the bonds given the Pennsylvania Co. in repayment of advances made for construction and betterments on the lines of the Pittsburgh, Cincinnati, Chicago & St. Louis. The Pennsylvania Railroad has this year expended over $15,000,000, it is stated, for new construction work and betterments on the lines east and west of Pittsburgh.

Pittsburgh, Akron & Western.—John W. Creech and others have begun legal proceedings at Akron, O., to secure an order from the court for the sale of this road under foreclosure of the first mortgage bonds. The road extends from Delphos east to Akron, O., 165 miles, and is now operated by W. A. Lynch as Receiver. The first mortgage was issued in 1890 and is for $3,630,000.

Port Royal & Augusta.—The Georgia Supreme Court has affirmed the appointment of Mr. J. A. Averill as Receiver of the company. The majority of the stock is owned by the Central Railroad of Georgia, but certain stockholders petitioned for the appointment of a separate receiver. A similar petition was filed in South Carolina where Mr. Averill was appointed Receiver. He was also appointed Receiver of the property in Georgia. This appointment was carried before the Supreme Court which has rendered its decision affirming the appointing of Mr. Averill, Receiver for the Georgia property of the road.

Sedalia, Warsaw & Southwestern.—The attorneys of the Missouri Pacific have decided to carry the contest for the control of this road to the Supreme Court of Missouri, and last week appealed from the decision of the Circuit Court appointing Jas. E. Thompson Receiver of the road, on the petition of Dwight Tredway of St. Louis and other minority stockholders who have not been satisfied with the management of the property by the Missouri Pacific.

South Carolina.—A final decree has been entered in the United States Circuit Court at Charleston, S. C., ordering the sale of the South Carolina Railroad, to take place on April 12, 1894.

Union Pacific.—The statement of earnings for September shows decreases in receipts on every division of the system, and the decrease of gross earnings on the entire mileage was $1,498,295, and the decrease in net earnings was $840,453. The tabulated reports for the whole system and several of the divisions are given below.

TOTAL OF UNION PACIFIC SYSTEM.

Month September:	1893.	1892.	Dec.
Gross earn.	$3,086,922	$4,585,217	$1,498,295
Net earn.	1,198,013	2,038,467	840,454
Nine months, to Sept. 30:			
Gross earn.	27,767,721	32,388,931	4,621,210
Net earn.	8,242,978	11,644,809	3,401,830

OREGON RAILWAY & NAVIGATION.

Gross earn.	283,595	520,988	237,393
Net earn.	85,409	229,808	144,399
Nine months:			
Gross earn.	2,657,660	3,238,372	580,712
Net earn.	548,950	822,611	273,661

UNION PACIFIC, DENVER & GULF.

Gross earn.	359,345	514,140	154,795
Net earn.	94,820	153,076	58,256
Nine months:			
Gross earn.	3,795,234	4,264,174	468,940
Net earn.	684,429	989,890	305,460

UNION PACIFIC SYSTEM PROPER.

September:			
Gross earn.	2,978,187	4,394,683	1,416,499
Net earn.	1,167,315	1,972,434	805,119
Since Jan. 1:			
Gross earn	26,696,564	30,976,322	4,279,758
Net earn.	8,043,196	11,206,136	3,162,940

The representatives of the various interests concerned in the reorganization of the company have selected the following committee to formulate a plan of reorganization: Senator Calvin S. Brice, who represents the Senate Union Pacific Railroad committee; Gen. G. M. Dodge and Gen. Louis Fitzgerald, representing the Sage, Dillon and Gould interests; A. H. Boissevain, for the foreign holders of the securities; Samuel Carr, representing the Ames estate and others, and Col. H. L. Higginson, for New England security holders, and J. Pierpont Morgan.

Union Pacific, Denver & Gulf.—The trial of the suit of John Evans, of Denver, against the Union Pacific was held in Denver last week. A receiver for the companies consolidatrd under the above title is asked, and damages for violation of the contract are wanted. It was the contention of the plaintiff that the Union Pacific managed affairs to the disadvantage of the revenues of the Colorado properties, and alleges a great number of specific violations of the agreement under which the consolidation was effected. The defense was that the management saved the Colorado lines from bankruptcy and placed the properties in better condition than before the consolidation, and that the spirit of the agreement had been kept. The court reserved decision.

Utah Central.—This road, now in operation between Salt Lake and Park City, Utah, 32 miles, was this week placed in the hands of a receiver at the suit of the Central Trust Company, of New York. James McGregor, the General Manager, and Clarence Cary, of New York, were named as receivers. The road defaulted in the interest on its bonds on Nov. 1, 1892, and has been in financial difficulties ever since the failure of its promoter, John W. Young, of Salt Lake City.

Western New York & Pennsylvania.—A plan for the reorganization of the railroad company, which for several months has been in the hands of receivers, has been completed and has received the approval of the Board of Directors and other parties interested. The plan, it is understood, will be made public in a few days.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, Nov. 29, 1893.

Substantial progress was made last week by the committee having in charge the formation of an agreement for the handling of west-bound immigrant traffic, and the co-operation of all the Western lines except the Union Pacific has now been secured. The agreement has been adopted by the other lines, and will be put into effect on Jan. 1, treating the Union Pacific as an outside line, and relying upon its assurances of co-operation. The Executive Committee intrusted with the carrying into effect of the agreement consists of Messrs. White, of the Santa Fe (chairman); Sebastian, of the Rock Island; Heafford, of the Milwaukee & St. Paul; Thrall, of the Northwestern; Townsend, of the Missouri Pacific; Eustis, of the Burlington; Lord, of the Chicago Great Western; Hanson, of the Illinois Central, and Chairman Caldwell, of the Western Passenger Association. The Committee will soon appoint a joint agent, and go to New York to arrange the details and open the joint office. The agreement as finally perfected is an admirable one, and if carried out in good faith will solve one of the most perplexing problems that has confronted the Western roads for many years, and save them many thousands of dollars which have been needlessly thrown away in commissions on this class of business. It provides for placing the entire westbound immigrant business absolutely in the hands of the Executive Committee for one year, to be handled by them through the joint agent at New York. No commissions are to be paid by any of the parties to the agreement except such as are duly authorized by the Committee, and those on vouchers properly approved by the chairman of the Committee, or some designated person. In short the Committee are vested with absolute authority to deal with the entire question and to provide the necessary machinery for carrying it into effect. The plan which they will adopt is one which will result in the maintenance of the agreement, provided only the lines co-operate as they are pledged to do. Provision is also madethat no commissions are to be paid on eastbound traffic except to regularly employed agents in charge of city or depot offices, and then only as authorized under the general agreement. Much credit is due to the members of the Committee for their tireless efforts during the past year to bring about the adoption of such an agreement.

There is no change in the transcontinental passenger situation. Western lines are powerless to settle it until the Southern Pacific and Canadian Pacific adjust their differences. The latter company is forcing the fighting by continued reductions in westbound rates from St. Paul via Victoria to San Francisco. On Nov. 27 a round trip rate of $65 was made from St. Paul and $30 first class and $23 second class one way. These rates added to the locals from Chicago to St. Paul make rates of $41.50 first class and $33.50 second class, as against $65.50 and $47.50 via the direct lines. None of the direct lines have as yet met the reduced rates and they say that they will not, claiming that travel will follow the direct lines rather than go around by Victoria and steamer. It is obvious, however, that the Canadian Pacific intends to keep on cutting until a point is reached where the financial inducement will draw the travel that way, and the indications are that unless the Southern Pacific soon accedes to the demand of the Canadian Pacific to let it sell tickets to San Francisco via the Shasta route a general demoralization will ensue.

Western lines have restored the army rate from Chicago to the Missouri River to $10.55.

The eastbound freight situation continues serious. charges are freely made, and apparently with foundation, that nearly if not all the eastbound roads are cutting rates. Eastern officials profess to make light of the charges, claiming that the equilibrium will be restored after Dec. 1, when the resolutions adopted at the last meeting of the Joint Committee go into operation. They are not so sanguine, however, about the export rate situation. There is no doubt whatever that the export freight is nearly all going by the Big Four and the Chesapeake & Ohio to Newport News; and if the export situation is not remedied there is little probability of restoring the domestic rates.

Western Passenger Association lines have agreed that from Dec. 1 baggage shall be checked to destination only, and will not be rechecked on 2d class or 1st class continuous passage tickets.

The shipments of eastbound freight, not including livestock, from Chicago, by all the lines, for the week ending Nov. 25 amounted to 53,981 tons, against 55,238 tons during the preceding week, a decrease of 1,257 tons, and against 61,818 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	W'k to Nov. 25.		W'k to Nov. 18.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	7,271	13.5	5,122	9.3
Wabash	3,819	7.1	4,383	7.9
Lake Shore & Michigan South.	8,712	16.1	11,910	21.6
Pitts., Ft. Wayne & Chicago	6,706	12.5	8,551	15.5
Pitts., Cin., Chicago & St. Louis	8,391	15.6	7,513	13.6
Baltimore & Ohio	2,616	4.9	2,745	5.0
Chicago & Grand Trunk	3,535	6 5	2,921	5.3
New York, Chic. & St. Louis	4,187	7.7	4,563	8.3
Chicago & Erie	6,788	12.6	5,903	10.6
C., C., C. & St. Louis	1,896	3.5	1,617	2.9
Totals	53,981	100.0	55,238	100.0

Of the above shipments 1,824 tons were flour, 22,011 tons grain and millstuff, 9,774 tons cured meats, 11,309 tons dressed beef, 1,078 tons butter, 2,084 tons hides and 3,320 tons lumber. The three Vanderbilt lines carried 37 3 per cent., the two Pennsylvania lines 28.1 per cent. The Lake lines carried 66,326 tons, against 80,933 tons during the preceding week, a decrease of 14,607 tons.

(Other Chicago traffic news will be found on page 870.)

RAILROAD GAZETTE

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$6.08 " " " FOREIGN COUNTRIES.

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United States Circuit Court,

SOUTHERN DISTRICT OF NEW YORK.

GEORGE WESTINGHOUSE, Jr., and THE WESTINGHOUSE AIR BRAKE COMPANY,
Complainants,
vs.
THE NEW YORK AIR BRAKE COMPANY, ISAAC B. NEWCOMBE, ROYAL C. VILAS, CHARLES A. STARBUCK and JOHN C. THOMPSON, Directors,
Defendants.
In Equity. No. 4,977.

THE WESTINGHOUSE AIR BRAKE COMPANY,
Complainant,
vs.
THE NEW YORK AIR BRAKE COMPANY, ISAAC B. NEWCOMBE, ROYAL C VILAS, CHARLES A. STARBUCK and JOHN C. THOMPSON, Directors,
Defendants.
In Equity. Nos. 4,976 and 5,315.

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CAUSTEN BROWNE,
Counsel for Defendants.

Opinion of Judge Townsend Sustaining the Broad Claims of the Westinghouse Quick-Action Air-Brake Patents.

TOWNSEND, District Judge: These are three bills in equity for the alleged infringement of letters patent No. 376,837, granted to George Westinghouse, Jr., Jan. 24, 1888; patent No. 393,784, granted to Harvey S. Park, Dec. 4, 1888; patent No. 172,064, granted to said Westinghouse, Jan. 11, 1876; patent No. 222,803, granted to said Westinghouse, Dec. 23, 1879, and patent No. 448,827, granted to said Westinghouse, March 24, 1891.

All of these patents are for improvements in railroad brakes. They describe and claim various devices used in the operation of automatic quick-action freight brakes, including the valve on the engine, operated by the engineer, and different forms of emergency valve apparatus on the cars.

General Character of the Defense.

The main defenses interposed to the chief patents in suit are non-infringement and lack of patentable novelty, upon the theory that the inventions therein claimed have been already described by said Westinghouse in other patents not in suit.

The parties in interest are the same in each case, but a difference in the ownership of the patents sued upon necessitated separate suits in the two earlier cases.

The patent sued upon in the third case is for a modification of the invention claimed in one of the other patents which had not been patented when said suits were brought.

The three cases will be considered in the order of the relation of the patents to each other.

History of the Development of the Air-Brake.

To understand the scope of the various claims of the patents in suit, it will be necessary to examine the state of the prior art.

The "Plain Brake."

The first practical air-brake is known as the "plain brake," and is described in patent No. 88,929, granted to George Westinghouse, Jr., April 13, 1869.

It consisted of a pump, operated by steam from the locomotive boiler, which compressed air into a reservoir located under the locomotive cab, which reservoir communicated by a pipe with a cock or valve in said cab, called the "engineer's valve," which was so located as to be readily manipulated by the engineer.

From this valve a pipe extended back under the tender, and was connected to a similar pipe under the entire length of the first car by a flexible hose. Each of the succeeding cars had a similar pipe similarly connected. This pipe was called the "train pipe." From the train pipe of each car a branch pipe communicated with the forward end of a cylinder called the "brake cylinder." This cylinder was provided with a piston, the stem of which was connected with the brake levers on the car. When the engineer wished to apply the brakes he opened the engineer's valve, and the compressed air from the main reservoir flowed back through the train pipe and branch pipes into the brake cylinder on each car, pushing the pistons backward, causing the piston stems to operate the brake levers and force the brakeshoes against the wheels.

When he wished to release the brakes he so shifted the valve as to shut off the flow of compressed air from the main reservoir, and to open a port or vent leading from the train pipe to the open air. Thereupon the compressed air in the brake cylinders escaped into the open air, the pressure of the pistons was removed, and the pistons were forced forward again by means of springs, thus moving the brakeshoes away from the wheels.

The validity of this patent was sustained in Westinghouse vs. Gardner & Ranson Air-Brake Company (9 O. G., 538).

Defects of the Plain Brake.

The operation of this plain brake was open to certain objections. It was too slow and was attended by danger of collision in case one part of the train became detached from the other part.

The Automatic Air-Brake.

The brake to be considered is known as the "automatic brake," which appears to have been patented by George Westinghouse, Jr., about 1872 or 1873.

It embodied the addition of an auxiliary reservoir and a triple-valve device to each car. Each reservoir was of sufficient capacity to operate its brakes once, thus to provide for automatic action in case of accident. The triple-valve device was located at the junction of connections between pipes leading to the train pipe, the brake cylinder and the auxiliary reservoir. In addition to these three ports, there was a fourth port leading to the open air.

Operation of the Automatic and Plain Brakes Compared.

The operation of this brake was radically different from that of the "plain brake." In the former, the compressed air was stored in the main reservoir until required for the application of brakes; in the latter, the main and auxiliary reservoirs and train pipe were always charged with compressed air at working pressure to prevent the application of the brakes. When the engineer wished to apply the automatic brake, he shifted the engineer's valve so as to cut off the flow of compressed air from the main reservoir and open a port from the train pipe to the open air. The effect of this was to reduce the air pressure in the train pipe, and cause a back pressure from each auxiliary reservoir through the triple valve, which shifted it so as to close the port from the branch pipe to the train pipe, and stop the escape of air from the auxiliary reservoir, to close the port leading from the brake cylinder to the open air, and to open the port leading from the auxiliary reservoir and connect it with the port leading to the brake cylinder. Thereupon the compressed air in the auxiliary reservoir flowed into the brake cylinder and applied the brakes.

It will thus be seen that, while the former system was operated by pressure from the main reservoir, the latter was operated by withdrawal of pressure. The result was automatic action in case of accidents, whereby air was caused to escape from the train pipe, as by bursting of hose or the train breaking in two. In such cases the release of pressure operated the triple valve and automatically applied the brakes.

Distinction Between Service Stops and Emergency Stops.

It is necessary here to consider "train brake graduation" or "service stops," as distinguished from "emergency stops." While for the latter it may be necessary to admit to the brake cylinder the full pressure of compressed air, say 70 or 80 lbs., yet, where it is desired merely to slow up without stopping, it may be necessary to admit only, say, 10 or 20 lbs., graduating the amount of flow according to the character of service desired. It is important to bear this distinction in mind, because the appliances hereafter to be considered have been so devised as to provide therefor, and that such graduation shall be under the control of the engineer.

Defects of the Automatic Brake.

The chief objection to this automatic brake lay in the fact that it was not capable of successful operation on long trains of freight cars. The time consumed by the progressive operation of the brakes between the grip on the first and last car allowed of so much slack motion between them as to cause violent shocks.

This automatic brake was publicly tested near Burlington, Ia., in 1886.

The growing importance of the subject of automatic freight graduation, the inadequacy of existing systems to protect the lives of railroad employees, and the disastrous results therefrom had become so evident that in 1885 the Railway Master Car-Builders' Association arranged for series of experiments known as the "Burlington trials."

Results of the Burlington Brake Trials in 1886.

The Westinghouse company and several other companies engaged in the manufacture of brake apparatus competed at these trials.

None of the competitors succeeded in stopping long trains of freight cars without violent and disastrous shocks.

Results of the Burlington Brake Trials in 1887—The Use of Electricity Demanded.

In 1887 the trials were renewed. There were five competing parties, including one of the leading experts for the defendants, and the complainant company. The latter then presented an improved apparatus covered by patent No. 360,070, granted to George Westinghouse, Jr., March 29, 1887.

The report of the committee of the Car Builders' Association shows that they considered "the field for improvement open as wide as in 1886," and concluded that air brakes actuated by electricity were the only ones likely to be capable of successful operation on long trains of freight cars. The improved Westinghouse apparatus, while it reduced the length of time between the application of the first and last brakes, produced greater shocks than did the automatic apparatus of the preceding year.

Success of the Quick-Action Automatic Brake Without the Use of Electricity.

In this condition of affairs George Westinghouse, Jr., set himself to work to obviate these difficulties. Upon the conclusion of the 1887 trials he renewed his investigations and experiments, and, by certain changes and improvements in the old apparatus and the introduction of new elements, he succeeded, in the latter part of the year 1887, in constructing a quick-

action automatic brake capable of being successfully applied to a train of 50 freight cars, and operative under all conditions of practical railway service.

On Oct. 1, 1887, he applied for a patent for this apparatus, and on Jan. 24, 1888, the patent was granted. Said patent, No. 376,837, is the first of the patents in suit.

Requirements of a Successful Air-Brake System.

Before proceeding to consider in detail the claims of this patent, it should be stated that the following were among the requirements for the practical operation of air-brakes:

1. The regulation of the force to be applied to the brakeshoes so as to secure all necessary graduations, from the mere slackening of speed to the service stop, and from the service stop to the emergency stop.
2. The automatic operation of the brakes in case of accident.
3. The practically simultaneous operation of the brakes on each car, so that, in long trains of freight cars, shocks might be avoided.
4. The control of all these operations by the engineer.
5. Certainty of operation under all conditions.

George Westinghouse, Jr., Was the Original Inventor of Each Form of Air-Brake.

It is not denied that George Westinghouse, Jr., was an original and meritorious inventor, the first inventor of the plain brake, the first to put an air-brake into successful use and the first to graduate air pressure in the brake cylinders. These facts appear in the opinion of the Court in Westinghouse vs. Gardner & Ranson Air-Brake Company, *supra*.

It is not denied that he was the first inventor, both of the Westinghouse automatic brake and of the Westinghouse quick-action automatic brake.

It appears that he was the first to provide an operative brake system without the use of electricity, and a device whereby the operation of the appararus was controlled by the engineer.

It is admitted by the expert for defendants that the Westinghouse quick-action automatic brake was the first practical system on long trains.

It is not denied that, immediately after its introduction, it went into successful extensive use and that 125,000 of said brakes have been furnished to the railroad companies of this country within a period of a little more than three years.

Contention of the Defendants.

But defendants claim that, by patent No. 162,465, to said Westinghouse and two associates, and by said patent No. 360,070 to said Westinghouse, he showed how practical air-brakes could be made and successfully operated. They admit that they have adopted these confessedly great inventions, but they deny infringement, on the ground that said patents Nos. 162,465 and 360,070, which imperfectly disclosed said great inventions, are not in suit. They further claim that the patents in suit are for mere minor improvements upon and modifications of said inventions, which did not require any exercise of creative thought.

Further defenses will be considered later.

The Inventions Embodied in the Quick-Action Automatic Brake Considered.

We will now examine these other great inventions.

They are comprised in what is known as the "Westinghouse quick-action automatic brake" apparatus.

The devices embodied therein are covered by said patent No. 360,070 and by patent No. 376,837, the patent in suit. The claims of defendants as to the scope of patent No. 162,465 will be considered in this connection.

It may be said in a general way that the "quick-action" element was added to, or the quick action was secured in, the automatic apparatus by such an arrangement of the triple valve in connection with vents on each car as to make the opening of such vents, and the consequent reduction of train pressure, practically simultaneous on each car. Its efficiency was increased by the utilization of the vented air to hasten the action of the ordinary brake force.

Patent No. 376,837 was issued to George Westinghouse, Jr., Jan. 24, 1888, for improvement in fluid-pressure automatic brake mechanisms.

Its object, as stated by the patentee, was "to facilitate the application of brakes with great rapidity and full or approximately full force, as from time to time required, by the provision of means whereby the admission of air from the brake pipe to the brake cylinders may be effected as directly as practicable, and through passages of as large capacity as may be desired."

The apparatus comprises a casing or air chamber, containing the triple valve device already referred to, which governs communication between the train pipe, the auxiliary reservoir and the brake cylinder, and also an emergency apparatus.

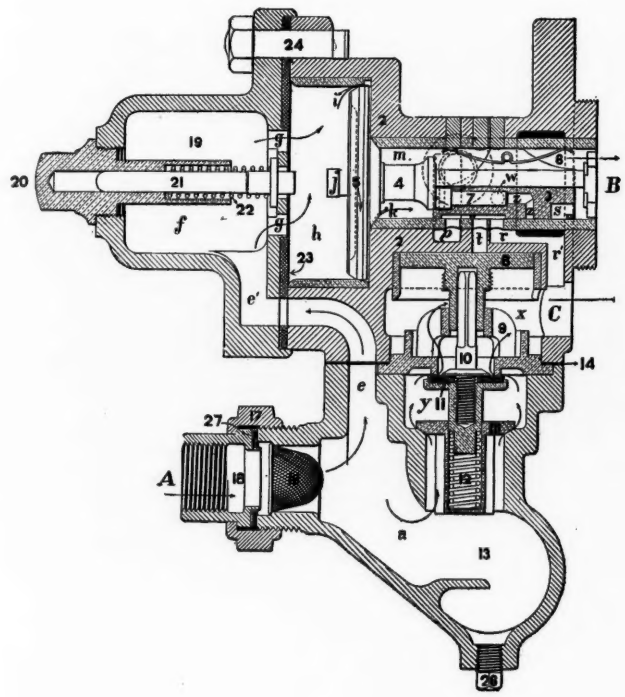
The patentee states that the construction and operation of the triple-valve device, except as to certain improvements therein, accord substantially with other such devices previously patented by him in patents Nos. 220,556 and 360,070.

It is not necessary to consider it in this connection, further than to say that it consists of a slide valve and free moving piston, so arranged as to be operated by variations of pressure in the train pipe. When a service stop is desired, a slight reduction of train-pipe pressure is made by the engineer. By reason of this withdrawal of pressure, the free moving piston which has heretofore been forced forward against the auxiliary reservoir by said train-pipe pressure, is now forced backward by the excess of pressure in the auxiliary reservoir until its movement is arrested by the decrease in auxiliary reservoir pressure, or by the striking of its stem against another stem, which is backed up by a spring.

It has, then, as already described, closed the charging port from the branch pipe, closed the port from the brake cylinder to the open air, opened the port leading from the auxiliary reservoir into the brake cylinder, and thereby caused the brakes to be applied.

The Quick-Action Feature of the Triple-Valve Described.

The quick-action element, which is the subject of the claim alleged to be infringed, is only called into action for emergency stops.



This emergency action is secured, in the patent in suit, by means of a separate supplemental piston and valve, in a supplemental valve chamber, below the main slide valve of the triple-valve device. This chamber connects the train pipe with the brake cylinder, communication between them being regulated by the supplemental valve, opening outwardly, or downward, and a check valve opening inwardly, or upward. These valves are held upon the seats, under ordinary conditions, by a spring bearing upon their stems.

In the bushing which forms the valve face of the main slide valve are four ports, governed by said slide valve.

One of these ports leads to the brake cylinder, two lead to the supplemental-valve chamber on the upper or inner side of the supplemental piston, and one leads to an exhaust port.

Operation of the Quick-Action Feature.

When an emergency stop is to be made, the engineer throws his engineer's valve wide open, thereby causing a sudden and material reduction of pressure. The excess of auxiliary reservoir pressure then forces the main piston stem against said other stem, overcoming the tension of its spring, drives the main piston to the extreme limit of its stroke, and thereby uncovers the port leading from the auxiliary reservoir to the supplemental valve-chamber. This pressure drives the supplemental piston outwardly, or downward, against the stem of the supplemental valve, and forces it from its seat.

Thereupon the preponderance of train-pipe pressure in the brake pipe opens the check valve, and the air from the train pipe rushes directly from the brake pipe to the brake cylinder.

The result of this operation is twofold. It hastens the application of the brakes on the car on which it is operated, and, by venting the train pipe, it hastens a similar reduction of pressure and consequent similar operation in the next succeeding triple-valve device on the next car.

The release of the brakes is accomplished by the admission of air from the main reservoir.

Claims of Patent No. 376,837 Alleged To Be Infringed.

It is alleged that defendants have infringed claims 1, 2, 3 and 6 of this patent. The first of these claims is as follows:

"In a brake mechanism, the combination of a chamber or casing, having direct connections to a brake cylinder and to a brake pipe respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of and unconnected with a triple-valve piston, and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve, substantially as set forth."

The second claim includes "a check or non-return valve controlling communication between said valve and the brake-pipe passage of the chamber, substantially as set forth."

The third claim is as follows:

"In a brake mechanism, the combination, with a triple valve, of a supplemental chamber or casing having passages leading to a brake cylinder and to a brake pipe respectively, a supplemental piston operating independently of the triple-valve piston and adapted to impart opening movement to said supplemental valve, and a passage establishing communication between said supplemental piston and an auxiliary reservoir, substantially as set forth."

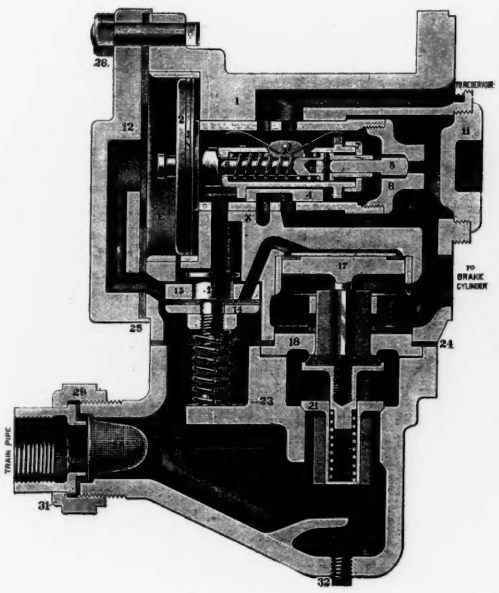
These three claims will be considered together.

The defense to these claims is non-infringement.

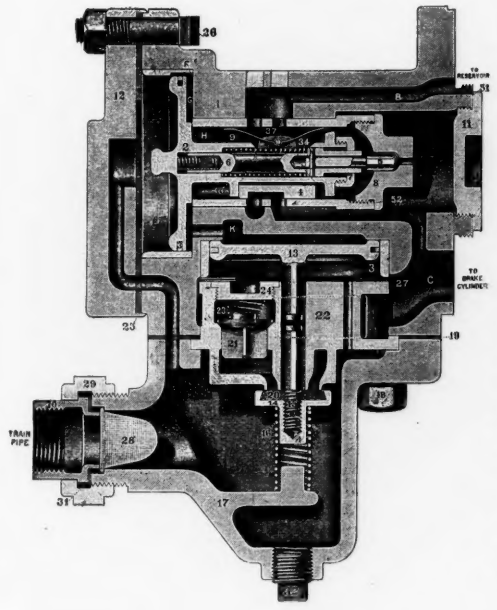
Description of Defendants' Quick-Action Triple Valves.

Defendants have used two devices, each of which compiainants claim is an infringement. The earlier device is known as "Defendants' Quick-Action Triple Valve"; the latter is "Defendants' Modified Quick-Action Triple Valve."

Each of these devices has a chamber, or casing, with direct connections to brake cylinder and train pipe, and a controlling valve, as in complainants' patent. Each has an emergency piston and valve and check valve.



The first form of defendants' apparatus has two emergency pistons and valves, or rather one emergency piston and valve, actuated by a sudden or large reduction of pressure, as in complainants' apparatus, and connected by means of a port with a supplemental piston and valve and check valve, like the single emergency piston valve and check valve of complainants.



The second or modified apparatus differs from the first in the elimination of one of the pistons with its valve and port of the emergency attachment, and modification of the check valve. It is not claimed that this modified check valve is an infringement of the second claim of the patent in suit.

Defendants' Position Defined.

The general questions of infringement claimed to be applicable to both devices will first be considered.

Defendants claim that their emergency apparatus, as well as that of the patent in suit, is merely a combination of the invention described in the automatic relief valve of one patent not in suit, with the invention whereby reservoir pressure was utilized to operate an emergency valve, described in a certain other patent not in suit.

The first of these patents is patent No. 162,465, issued to Messrs. Ford, Welsh and said Westinghouse, April 27, 1875, for an Improvement in Automatic Air Escapes for Railway Air-Brakes.

At the date, both the old plain-brake apparatus, depending for its braking operation upon the transmission of compressed air from the engine to the brake cylinders, and the automatic system, depending upon the release of the pressure of compressed air to apply the brakes, were in use. Patent No. 162,465 was only designed for use in connection with the plain apparatus. The subject of the invention was, "to provide for the more immediate escape of the compressed air from the brake cylinders after it has done its work." It was a patent for an invention, not for applying brakes, but for quickening the releases of the brakes in the plain-brake system. The invention comprised an auxiliary reservoir connected with the brake pipe, and having a lift valve controlling vents from the train pipe into the open air. This valve was so arranged that, when there was an equilibrium of pressure, it remained on its seat. Through the center of the valve was a small hole leading to said reservoir. When air was transmitted from the engine to apply the brakes, it flowed through said hole into said reservoir, making the same pressure there as in the train pipe. But when the air was discharged from the train pipe to release the brakes, the excess of pressure of the air within said chamber unseated said valve, and allowed the air to be rapidly vented from the brake cylinder and brake pipe into the open air.

The defendants claim that they took their relief valve from this patent, and that Westinghouse embodied this idea in patent No. 376,837, and that it was not first conceived in said patent. They say that the first result in each case was to quicken the action of each succeeding automatic relief valve, and the difference in secondary results, that in one case it released, in the other applied, brakes, is immaterial.

Defendants' Position Is Untenable.

I do not think this patent anticipates or limits, in this connection, patent No. 376,837, for the following reasons:

The sole object of the invention was to quickly release brakes in the direct system. It was intended to obviate the difficulty arising from the fact that in the direct system the escaping air, being expelled simply by its own expansion, came out very slowly. It was not adapted to the application of brakes, or in any way to the automatic brake system, although that system had then been invented.

Counsel and experts for defendants admit that radical and material modifications were required before it could be practically applied to railroad service under the automatic system.

There is no suggestion in the patent of any way in which it could be adapted to the automatic system, nor, if so adapted to apply the brakes, does it appear how it could then be operated to release them. No provision is made for graduation for ordinary service stops in any case.

In Edison Electric Light Co. vs. Westinghouse (55 Fed. Rep. 504), Judge Green, citing cases, says:

"And for this cause alone the Khotinsky patent cannot be relied upon in this case as an anticipation of the plaintiff's patent. It does not anticipate, because it neither describes nor deals with, nor certainly provides for, the difficulty, nor prescribes with precision the remedies which form the subject matter of Edison's invention."

It appears from the evidence that if patent No. 162,465 were so reorganized and reconstructed as to be used to apply brakes in the automatic quick-action system, it would then be utterly inoperative for accomplishing the purpose of the original invention.

But, say counsel for defendants, given the solution of the problem how to release pressure quickly in a long pipe, its application to a different system, for a different purpose, in a different way, and producing a different result, is a mere double use.

The considerations already suggested would seem to be a sufficient answer to this claim. It may be added, as is forcibly urged by counsel for complainants, if this was merely a thing that "any competent mechanic could do," why was George Westinghouse the only person to whom it occurred to do it, and how to do it?

The claim of defendants that all this was done in patent No. 360,070 will be considered in connection with that patent.

Mr. Westinghouse Invented and Created a New Device in the Quick-Action Triple Valve of Patent No. 376,837.

Even if Mr. Westinghouse, in patent No. 376,837, did, as claimed by defendants, throw his mind back to patent No. 162,465, and use it as a basis for a part of the contrivance of patent No. 376,837, he did not reinvent patent No. 162,465, but he invented and created a new device, adapted to new conditions and developed in new combinations, which produced new and different results.

These facts would seem to bring this branch of the case within the rule as stated in Ansonia Co. vs. Electrical Supply Co., 144 U. S. 11: "If an old device or process be put to a new use which is not analogous to the old one, and the adaptation of such process to the new use is of such a character as to require the exercise of inventive skill to produce it, such new use will not be denied the merit of patentability."

In Walker on Patents, 2d ed., p. 54, it is stated that "Novelty is not negatived by anything which was neither designed, nor apparently adapted, nor actually used to perform the function of the thing covered by the patent, though it might have been made to perform that function by means not substantially different from that of the patented invention."

It seems to me, therefore, that the invention described in patent No. 162,465 did not anticipate the invention described in the patent in suit.

As was said by Mr. Justice Browne, in Topliff vs. Topliff, 145 U. S. 161:

"It is not sufficient, to constitute an anticipation, that the device relied upon might, by modification, be made to accomplish the function performed by the patent in question if it were not designed by its maker, nor adapted, nor actually used, for the performance of such functions."

The First Quick-Action Patent of Mr. Westinghouse Does Not Impair the Validity of Later Patents.

The next patent to be considered is No. 360,070, granted to George Westinghouse, Jr., March 29, 1887, for Fluid Pressure Automatic Brake Mechanism. This was the first patent issued for the Westinghouse automatic quick-action system.

The defendants say that this patent fully disclosed another confessedly great invention, namely, the utilization of the air vented from the train-pipe, to quicken the application of brakes. They further urge with great force that, even if certain modifications were required in patent No. 162,465 before it could be adapted to act in the automatic quick-action system, yet that, in connection with patent No. 360,070, it shows the combination of everything vital and essential in the patent in suit.

The complainants deny these claims, and urge that the facts already stated, as to the defects developed at the Burlington trials in the apparatus constructed in accordance with this patent, call for the application of the rule laid down in Webster Loom Co. vs. Higgins, 105 U. S. 591, where the Court, in disposing of a similar claim, said: "This argument would be sound if the combination claimed by Webster was an obvious one for obtaining the advantages proposed—one which would occur to any mechanic skilled in the art. But it is plain from the evidence, and from the very fact that it was not sooner adopted and used, that it did not, for years, occur in this light to even the most skillful persons."

Description of the First Quick-Action Triple Valve.

In patent No. 360,070, Westinghouse sought to secure both service and emergency action by the use of single piston—the piston of the triple valve already described.

This piston was so arranged as to have only a slight range of motion for a service stop. A great reduction of pressure for an emergency stop would cause the piston to travel through its entire range of motion and to uncover an emergency port, through which train-pipe pressure passed from the train or brake pipe into the brake cylinder.

The Broad Distinction Between the First and Later Quick-Action Devices.

The radical difference between this patent and the patent in suit consists in the difference of construction and operation involved in the addition to the latter of the separate emergency apparatus.

Defendants' View of the Distinction.

The defendants claim that the secret of the success of the patent in suit lies not in the use of a separate piston to operate the emergency valve, but in the substitution therein of a lift valve, such as was used in patent No. 162,465, in place of the slide valve of patent No. 360,070.

One of the experts in one of the other cases and all the counsel in this case refer to the tendency of the slide valve of patent No. 360,070 to stick to its seat, especially if used in connection with a large port, such as is found necessary for the successful operation of patent No. 376,837.

Fig. 8 of the patent in suit shows a slide valve as interchangeable with a lift valve. The device shown in complainants' exhibit of its automatic brake system has a lift valve.

The experts for complainants testify fully as to the advantages secured by the use of the separate emergency valve and piston, and, in this testimony, they are not contradicted by the experts for defendants.

Defects of the First Quick-Action Apparatus in Its Original Form.

In this connection, and as having an important bearing upon this question, the evidence as to the practicability of patent No. 360,070 will be considered.

It appears that the apparatus constructed thereunder did not operate satisfactorily in the Burlington trials. But it also appears that these defects were not occasioned by any inherent defects in the construction of the device shown in patent No. 360,070, and that when the accessory parts were afterward adjusted, and, as testified by Mr. Westinghouse, "when the passages through the quick-action portion of the triple valve were made sufficiently large, practically the same results were obtained in train stopping as were subsequently obtained by the kind of valve shown in patent No. 376,837."

It seems to me that this uncontradicted evidence is entitled to great weight as against the contention of defendants' counsel that "the essential matter in patent No. 376,837 is the use of the lift valve instead of a slide valve."

The Evidence of Defendants' Expert Undermines the Position of Defendants.

This conclusion is strengthened by the evidence of Mr. Massey, one of the experts for defendants, and the patentee of defendants' quick-action triple valve.

As complainants' counsel agree that the cause of the difficulty, in patent No. 360,070, and the way in which it was obviated in patent No. 376,837 are fully and clearly stated by Mr. Massey, I give his evidence in full upon this point.

Mr. Massey was asked, on direct examination, as follows.

"Int. 4. Mr. Henry B. Stone, in his deposition, says that he has no doubt that the Westinghouse quick-action automatic brake was the first practical quick-action triple valve which made the automatic brake system practical on long trains, and, as I interpret the testimony of Mr. H. Herman Westinghouse, he says the same thing. What is the practical objection, if any, to the quick-action triple valve of 360,070, and how is that remedied by the apparatus of 376,837? Before answering, state what is meant by the 'Westinghouse quick-action automatic brake.'"

"Ans. The term 'Westinghouse quick-action automatic brake,' as used by Mr. Stone, undoubtedly refers to the quick-action triple valve described in patent 376,837, and illustrated on sheet 2 of that patent. It is also the quick-action triple valve which is illustrated in the Westinghouse catalogue of 1890."

"In the quick-action triple valve described in 360,070, in addition to the triple valve, the stem of the piston came in contact with an emergency valve, and the extreme motion of the triple valve piston caused the emergency valve to open a small passage between the train pipe and the brake cylinder, thus causing a local exhaust of the air from the train pipe, and therefore reducing the pressure in the train pipe quicker than would be done by the vent through the engineer's valve. The port which was opened by the emergency valve was necessarily restricted in size as, in order to be effective, the piston of the triple valve must be able to open it within a moderate reduction of train-pipe pressure, and, therefore, with but little force in addition to that consumed by the piston in moving the ordinary triple valve mechanism. If the emergency valve had been arranged to open a very large port, the time required to exhaust the train pipe through the engineer's valve sufficiently to allow the piston to open the emergency valve would be materially increased."

"This defect in the emergency valve of 360,070 would not be serious in trains of moderate length, as under, say, twenty-five cars; but in the 50-car train used at Burlington in May, 1887, the effect was disastrous. This defect is remedied in 376,837 by using supplemental piston to open the emergency valve and actuating that piston by fluid pressure from the reservoir through a passage controlled by a valve which is actuated by the triple valve piston. In this case the triple valve piston has only to open a comparatively small port in addition to its regular function and fluid pressure in the auxiliary reservoir then causes the supplemental piston to open the emergency valve."

"The length of time required in the use of the single valve of patent No. 360,070, to open a sufficiently large port, above referred to, appears to have been in the mind of Westinghouse in providing a separate piston of the patent in suit to open the emergency valve, for, in the description of this improved invention, it will be remembered, he states that 'its object is to facilitate the application of brakes with great rapidity and full or approximately full force, as from time to time required, by the provision of means whereby the admission of air from the brake pipe to the brake-cylinders may be effected as directly as practicable, and through passages of as large capacity as may be desired.'"

It seems to me, in view of this testimony of defendants' expert, and the other evidence already considered, that the defendants have failed to sustain the burden of proving that the conceded success of the patent in suit was due to the substitution of a lift valve instead of a slide valve.

Defendants Contend that Later Patents Must Be Narrowly Construed Because the Rights of Partnership Were Neglected.

But certain other considerations are suggested by counsel for defendants in this connection—namely, that in patent No. 360,070 Westinghouse describes a combination whereby auxiliary reservoir pressure is utilized so as to impart opening movement to the emergency valve, and vent the air from the train pipe to the brake cylinder; and that, in patent No. 376,837, the operation of such apparatus was through a passage controlled by a valve, actuated by the triple valve piston. And defendants further claim that this patent is limited by the words and figures of the specification to a construction where the emergency valve is only exposed to auxiliary reservoir pressure by the excess stroke of the triple valve opening a passage.

Upon these claims, among others, is laid the foundation of the main defense, namely, that this broad, fundamental conception of the inventor, having been disclosed to the world in patent No. 360,070, they are now entitled to avail themselves of it, and to use it in connection with the suggestions contained in paten No. 162,465, in making their apparatus. They admit that patent 376,837 describes an improvement on patent No. 360,070, but they claim that said improvement is merely a minor invention.

General Consideration of Pioneership.

The consideration of the general questions of pioneership involves the inquiry as to whether the patented device contained an invention which, for the first time, enabled "a law of science, or force of nature, to be used so as to accomplish a practical and beneficial result." (Judge Shipman, in Dederick vs. Seigmund, 1 U. S. Appeals, 227; Morley Machine Co. vs. Lancaster, 129 U. S., 263.)

In this inquiry is necessarily involved the determination, in this case, of the question as to whether this great invention was so disclosed to the world in patent No. 360,070 as to make it available without a further exercise of the inventive faculty.

The argument of counsel for complainants and defendants on this question seems to assume that whether the defendants are infringers or not largely depends upon whether patent No. 376,837 is or is not a pioneer patent.

It is questionable whether a court may safely depart from the ordinary rules in the construction of a patent because it may seem to bear the brand of pioneership. In the present case, too, the application of the principle is not without difficulty, because the inventor is confessedly a pioneer, the question being whether he had not already blazed a pathway through the forest before he laid out or opened the practicable public highway.

The Case Does Not Call for a Decision Under the Doctrine of Pioneership.

I have, therefore, attempted to dispose of the questions herein by a consideration of the prior art, and a comparison of defendants' devices, with the patent in suit, independently of the doctrine of pioneership.

If this doctrine is applicable, the case seems to fall within the principle stated and followed by Judge Coxe in Mergenthaler Linotype Co. vs. Press Publishing Co., 57 Fed. Rep. 502.

In either case "a strict construction should not be resorted to if it becomes a limitation upon the actual invention, unless such construction is required by the claim, it being understood that the construction should not go beyond and enlarge the limitations of the claim" (Smead Warming & Ventilating Co. vs. Fuller & Warren Co., Circuit Court of Appeals).

Definition of the Invention in Patent No. 376,837.

It will be remembered that the provision for a separate emergency piston to open the emergency valve and for the operation of that separate piston by pressure from an auxiliary reservoir in direction to impart opening movement to the emergency valve, was new with Westinghouse in patent No. 376,837.

But it will be remembered that, in patent No. 360,070, Westinghouse had provided for the utilization of reservoir pressure, to cause the single piston of the triple valve to make an extreme travel for an emergency stop, and to thereby uncover an emergency valve.

The considerations already suggested seem to show that each of the patents already discussed, patents Nos. 162,465, 360,070 and 376,837, marked a forward step in the progress of the freight-brake system, and that each contributed an important and essential element of invention thereto.

The scope of these patents has been already considered. If all that is claimed as to the inventions disclosed in the patents not in suit be admitted, it still appears that the patent in suit describes an improvement on patent No. 360,070, which was not applied for until more than six months after patent No. 360,070 had been granted and after a series of practical experiments undertaken for the purpose of obviating the difficulties encountered and defects developed in the Burlington trials of 1887. "Experiments made to ascertain the practicability of the new use are strong evidence to prove that invention was required to conceive of it."

Merwin on Patentability of Inventions, § 92.

It further appears that the apparatus constructed under said patent was the first successful embodiment of these great inventions, and furnished the first and only practical solution of the problems of automatic quick-action freight brakes.

It further does not appear that the success of the invention embodied in the patent in suit is not due to the use of the separate emergency piston and valve.

The Defendants' Devices Were Suggested to Them by Patent No. 376,837.

It seems to me most significant that, with patent No. 360,070 before the world for six months, and under the pressure of competitive trials, no one so grasped the inventions claimed to be disclosed in patent No. 360,070 as to embody them in a successful working apparatus until after the patent in suit had been applied for, and that, when defendants constructed an apparatus, they adopted the separate emergency piston and valve of the patent in suit.

Each of Defendants' Quick-Action Triple Valves Infringes Patent No. 376,837.

And as patent No. 376,837 accomplished this result by the use of a separate piston, and as defendants' apparatus have accomplished this result also by the use of one or two separate pistons, they must be held to have infringed the first and third claims of said patent unless said claims are to be so limited in terms, or by the information disclosed in patents Nos. 162,465 or 360,070, or both, as to show that defendants' device is not embraced therein.

In this connection it will be necessary again to examine the first claim of the patent in suit, which is as follows: "In a brake mechanism, the combination f a chamber or casing having direct connections to a brake cylinder and to a brake pipe respectively, a valve controlling communication between said connections, and a piston or diaphragm which is independent of and unconnected with a triple valve piston and is actuated by pressure from an auxiliary reservoir in direction to impart opening movement to said valve substantially as set forth."

Dependency of the Westinghouse Quick-Action Apparatus Upon the Action of the Main Slide Valve Alleged.

Defendants claim that complainants' emergency piston is not "independent of and unconnected with a triple-valve piston," except in that sense that there is no dependence or connection by direct mechanical action, and that complainants are, in fact, limited to a construction in which the emergency piston is dependent upon and connected with the triple-valve piston, and in which the emergency valve is not exposed to auxiliary reservoir pressure, except by the excess stroke of the triple valve opening a passage.

These propositions will be considered together.

In the drawings of the patent it appears that while the emergency piston is distinct and separate from the triple-valve piston, yet that it is operated by reservoir pressure admitted by means of an excess stroke of the triple-valve piston.

In this sense the action of complainants' emergency device may be said to be dependent upon the action of the triple-valve piston.

In a Similar Sense the Quick-Action Apparatus of the Defendants Is Dependent Upon the Action of the Main Slide Valve.

A similar element of dependence is to be found in the operation of defendants' device. For before their emergency piston can operate to apply the brakes, some movement of the triple-valve piston is necessary in order to shut off the exhaust from the open air.

In neither of said devices is there any direct mechanical connection between the triple valve piston and the emergency piston; in each there is an indirect communication—although it is mechanically more remote in the first device of defendants.

Such Indirect Dependence is not Material to a Limitation of the Claims.

Under these circumstances it is questionable whether such incidental communication is material upon the question of infringement.

I do not think the language "independent of and unconnected with" should be construed to mean "dependent and indirectly communicating with," so as to necessarily cover such indirect dependency, or to make it an essential feature of the invention, and thus do violence to the language of the claim.

Significance of the Term "Substantially as Set Forth."

But the learned senior counsel for defendants assumes that the second form of defendents' apparatus contains all the parts covered by Claim 1 of patent No. 376,837, but he forcibly claims that the parts do not operate "substantially as set forth" in the patent.

It was claimed by him that the description and all the drawings of said patent showed an emergency valve not exposed to auxiliary reservoir pressure except by the excess stroke of the triple valve opening the passage, and that in that event the case would fall within the rule laid down by Judge Wallace and affirmed by the U. S. Supreme Court, in Snow vs. L. S. & Mich. Southern R. R. Co., 121 U. S., 617.

But, counsel for complainants having called my attention to fig. 12 of said patent, and the description thereof, I have carefully examined and considered the same, and, while I cannot find therein any description of the particular way in which the requisite air is to be admitted, it does appear that the emergency piston is not there shielded from auxiliary reservoir pressure, except by the excess stroke of the emergency piston, because, in ordinary braking, where there is no excess stroke, such reservoir pressure is directly exerted upon said piston.

In the description of the invention by the patentee, there is no statement that the emergency valve is to be shielded from reservoir pressure until it is brought into operation. No such limitation is stated in the claim; no movement of the triple-valve piston is described in fig. 12. The emergency piston may or may not be shielded from auxiliary pressure. Therefore, when the patentee claims the combination "substantially as described," he ought not to be held to a construction not specified, either in the description or claim, especially where such construction does not appear to be material, and where it only concerns the apparatus when not in use, and does not affect it at all when in operation.

Robinson on Patents, § 517, § 750.

The Broad Claims Must Not Be Limited by Reading Into Them Unwarranted Clauses.

The rule that the claim must be limited to the invention does not necessitate reading into the claim something not specified or necessarily implied therein (Lake Shore & M. S. Co. vs. Nat. Car Brakeshoe Co., 110 U. S., 229; Edison Electric Light Co. vs. Westinghouse, 55 Fed. Rep. 498).

The distinction between this case and Snow vs. Lake Shore & Mich. So. R. R. Co., *supra*, appears from the opinion of Judge Wallace in said case, where he says: "The plain and explicit language of the specification requires a construction of the first claim which will enable the defendant to escape liability as an infringer. . . . The specification states that 'the piston is disconnected from its rod to prevent any lateral strain being communicated to it.' . . . The drawings show a detached piston rod, and all the co-operative devices are conformed and adjusted to a detached rod." And in said case Judge Wallace held, and the United States Supreme Court, affirming his decision, held, that it was "impossible to ignore the particular construction of these two parts which are thus pointed out as material."

In said case the claim stated the combination, where "constructed and operated, substantially as described."

The Patentee Should Be Protected by as Liberal a Construction as Is Consistent with the Wording of Specification and Claims.

In Van Harter vs. Miller, 15 Blatchf., 562, Judge Wallace states the rule as follows: "In construing a patent it is, first, pertinent to ascertain what, in view of the prior state of the art, the inventor has actually accomplished, and this having been found, such a construction should be given as will secure the actual invention to the patentee, so far as this can be done consistently with giving due effect to the language of the specification and claim."

The words "substantially as set forth" mean substantially as set forth in regard to the combination which is the subject of the claim, and they should be given a construction commensurate with the real invention, so as to protect the inventor.

Lake Shore, etc., R. vs. Nat. Car Brake Shoe Co., *supra*.
Winans vs. Denmead, 15 How., 330.
Grier vs. Castle, 17 Fed. Rep., 523.

The Rights of Mr. Westinghouse Were Not Restricted by the Language of the Claim.

A patentee may, of course, by the language of his claim restrict the scope of his rights under his invention, but as no such restriction is to be found in said claim we are limited to a comparison of the operation of the structural law of the patented machine with that of the alleged infringing machine.

Robinson on Patents, § 962.

Object of the Supplemental Piston of Defendants First Quick-Action Device.

It remains to further consider certain suggestions in regard to the piston and supplemental piston of defendants' earlier devices.

When this emergency piston is called into operation by a sufficient reduction of pressure it is not, as in complainants' device, so driven by auxiliary reservoir pressure as to act directly on the emergency valve, but when so forced down it opens a port whereby train pressure is admitted to the upper side of the other piston, which, being thereby forced down, imparts opening movement to an emergency valve leading to the brake cylinder.

Defendants' Contentions Concerning the Supplemental Piston.

We have here the triple-valve piston and two other pistons used to accomplish the work of the one piston in complainants' device; and defendants claim that in their device there is not the combination of triple-valve piston and emergency valve, because the first of these two pistons does not impart opening movement to the emergency valve, its only function being to uncover a port whereby air is admitted to the brake cylinder, and the train pipe is vented.

They further claim that the second supplemental piston in said device is not actuated by reservoir pressure, but by train pressure.

Of the two separate or emergency pistons of the defendants, one opens a port which admits train pressure to the other. The former is directly actuated by pressure from the auxiliary reservoir; the latter is directly actuated by pressure from the auxiliary reservoir in the sense that such pressure necessarily results in operating it through the intermediate operation of the former.

The Supplemental Piston Is a Mere Evasion by Dividing the Emergency Piston Into Two Parts.

The question is, whether this combination of devices is the same as the device of complainants. It seems to me that it is. The component parts of the combination operate together "to perform the same function and to produce the same result."

It is merely dividing complainants' piston into two parts, so arranged that the action of one necessarily causes the action of the other in the same way as though they were one.

"A patent for a device cannot be avoided by dividing it into two parts which, when combined, produce the same result in substantially the same way. . . . With reference to the object in view—the raising and lowering of the fingers, which is the useful purpose contemplated—the effect is identical. The means . . . are substantially the same, and they operate, . . . in substance, in the same manner. To hold otherwise would be to give to immaterial variations capacity practically to destroy the value of any patent whatever" (Judge Woodruff, in Wheeler vs. The Clipper Mower & Reaper Co., 10 Blatchf., 181).

In the case of Strobridge vs. Lindsay *et al.*, 6 Fed. Rep., 510, a case somewhat similar to the one at bar was presented. The complainant was the owner of a patent for a coffee mill. The claim in suit was for "a detachable hopper and grinding shell formed in a single piece," etc. The defendants having been enjoined, made a new mill, in which the hopper and grinding shell were cast separately. Judge Acheson held that this did not avoid infringement, and said: "The change is but colorable. Although cast in two pieces, yet, when put *together for use*, the hopper and grinding-shell are substantially, and for all practical purposes, 'formed in a single piece.'"

The same view was held by the Supreme Court of the United States in Blake vs. Robinson, 94 U. S., 728.

While the Piston Remains Inactive, the Pressures Upon Its Face Are Immaterial.

I have not overlooked the distinction between the atmospheric pressure on both sides of the emergency valve of complainants, and the auxiliary reservoir pressure on one side, counterbalanced by train pressure on the other side of defendants' device. This difference does not affect the operation of the emergency piston.

The Admission, by the Defendants, of the Inferiority of Their Apparatus Is Not a Valid Defense.

The concession by defendants that complainants' valve is, for this reason, a better valve does not seem to me to help the defendants.

If the defendants have made a different construction in this respect which is inferior to that of the patent in suit, by reason of its tendency to leak, while retaining the other elements of the combination of complainants, it seems to me that this fact suggests that the claimed difference is only a colorable one, merely designed to get rid of the claims of the patent in suit.

Strobridge vs. Lindsay *et al.*, *supra*.

Besides, these advantages of complainants' construction over that of defendants', suggested by counsel for defendants, were not what the inventor was seeking to obtain. He was not trying to invent a non-leakable valve, nor a valve which should necessarily be limited in arrangement or shielded in a particular way while not in operation.

The Question, Upon Which Infringement Depends, Clearly Defined.

The object of his invention was to provide an emergency valve which should act certainly and effectively in an emergency. The question is, whether the operation of defendants' device when in action is the same, and produces the same results, as that of complainants.

"In determining the question of infringement, the court or jury . . . are to look at the machines or their several devices or elements in the light of what they do or what office or function they perform, and how they perform it, and to find that anything is substantially the same as another if it performs substantially the same function in substantially the same way to obtain the same result" (Justice Clifford, in Machine Co. vs. Murphy, 97 U. S., 120; Cantrell vs. Wallick, 117 U. S., 689; Waterbury Brass Co. vs. Miller, 9 Blatchf., 77).

In regard to all these alleged differences of construction, the language of the Supreme Court, in Sessions vs. Romadka, 145 U. S., 45, seems to be directly in point, where Mr. Justice Brown, speaking for the Court, says: "In view of the fact that Taylor was a pioneer in the art of making a practical metallic trunk fastener, and invented a principle which has gone into almost universal use in this country, we think he is entitled to a liberal construction of his claim, and that the Romadka device, containing as it does all the elements of his combination, should be held an infringement, though there are superficial dissimilarities in their construction."

What has already been said has been directed chiefly to the combination described in the first claim of complainants' patent. The additional check valve claimed in the second claim is found in the defendants' first device.

The elements of the third claim are in the main the same as in the first claim, and the additional element,

a passage between the supplemental piston and auxiliary reservoir, is found in defendants' device.

Both Forms of Defendants' Quick-Action Triple Valves Are Infringements.

As a result of these considerations, I have reached the conclusion that the first form of defendants' apparatus, the "Quick-Action Triple Valve," infringes the first three claims of the patent in suit, and that the second form, the "Modified Quick-Action Triple Valve," infringes the first and third claims of the patent in suit

The Sixth Claim of Patent No. 376,837 Considered.

The sixth claim of patent No. 376,837 reads as follows:

"In a brake mechanism, the combination of a triple-valve casing, a supplemental valve chamber composed of an inner section which is formed integral with the triple-valve casing, and a separable outer section, each having a lateral air pipe or passage, and a supplemental valve seat formed in a division plate or partition interposed between and secured to the two sections of the supplemental valve chamber, substantially as set forth."

The alleged invention herein consisted in so arranging the triple-valve casing as to include therein part of the chamber of the emergency valve, leaving the other part to be made separately. In this way, it is claimed that the construction of the apparatus was simplified.

The Sixth Claim Not Sustained—as Not Constituting Invention.

It is admitted that the construction of defendants' casing is the same as that claimed by complainants. The defense is lack of invention. I think the defense is fully made out. If it required any inventive talent to suggest the details of construction, they are found in the Massey patent No. 358,867. But it seems to me that it is merely a convenient way of putting the parts together, which would have occurred to any one. "It is but the display of the expected skill of the calling, and involves only the exercise of the ordinary faculties of reasoning upon the materials supplied by a special knowledge and the facility of manipulation which results from its habitual and intelligent practice, and is, in no sense, the creative work of that inventive faculty which it is the purpose of the Constitution and the patent laws to encourage and reward" (Justice Matthews, in Hollister vs. Benedict Mfg. Co., 113 U. S., 59; Deere & Co. vs. J. I. Case Plow Works, 56 Fed. Rep., 841).

As already stated, the third case is based upon a patent which had not been granted when the other suits were brought. As it involves a further consideration of the devices and defenses already discussed, it will be disposed of in this connection.

Claims of the Divisional Patent No. 448,827, in the Third Suit.

This suit is for the alleged infringement of Claims 1 and 2 of patent No. 448,827, granted to George Westinghouse, Jr., March 24, 1891, for an air-brake. This is a divisional patent, having been originally applied for as part of patent No. 376,837, which has just been considered.

Said claims are as follows:

"1. In a fluid-pressure brake apparatus normally operated by a triple-valve device, the combination, with such an apparatus, of a valvular appliance having a casing provided with supply and discharge passages or connections, and a valve controlling an exhaust port from the supply passage to the discharge passage for quickly releasing pressure in the supply passage, said valve being actuated to open the exhaust port by a greater than normal reduction of pressure in the supply passage independently of the action of the triple-valve device, substantially as set forth."

"2. The combination, with a triple-valve mechanism, of a discharge valve controlling an exhaust port from a supply passage to a discharge passage for quickly releasing the pressure in the supply passage, said valve being actuated to open the exhaust port by fluid pressure in an auxiliary reservoir on reduction of pressure in the supply passage below the normal degree, in whatever position the slide valve of the triple-valve mechanism may be brought by such reduction, subtantially as set forth."

Description of the Invention Embodied in the Divisional Patent.

It appears, from the specification, that the object of said invention was "to provide means for effecting the rapid admission of fluid under pressure to a desired delivery receptacle by means of, and coincidently with, a reduction of pressure in the receptacle of a fluid supply," and that the means by which this object was to be attained could be used with or without a triple valve apparatus. All the drawings, except the first, show the appliance as connected in operative relation with such triple-valve apparatus.

The alleged invention consists of a valve controlling communication between a supply passage from the trainpipe and a delivery passage to the open air or a brake cylinder. This valve is held in position by a spring, so as to close ports leading to the delivery passage, and not to be moved from its seat by ordinary reductions of pressure for service stops. There is also a diaphragm and valve stem interposed between the supply passage and a passage to a special reservoir, or an auxiliary reservoir. Said controlling valve is connected to said valve stem. Train-pipe pressure passes through a small passage in said diaphragm into said reservoir, thus equalizing pressure on the opposite sides of said diaphragm.

Upon a sudden reduction of pressure, sufficient for an emergency stop, the excess pressure on one side of said diaphragm moves it and its valve stem and the said controlliug valve downwardly, so as to open said ports and allow the compressed air to pass through the delivery passage to the open air or brake cylinder.

Defendants Admit Infringement, but Deny the Validity of the Claims.

Defendants admit infringements of claims 1 and 2, but they urge that said claims are void, alleging the following reasons:

"I. They must be construed to cover (*a*) the mere transfer of the automatic relief valve of 162,465 from the direct system to the automatic system, which is a mere double use, and not an invention; (*b*) the mere substitution for the automatic relief valve shown in 360,070 of the automatic relief valve of 162,465, which is a mere substitution and not an invention."

"II. There is no invention described in 448,827, in view of 162,465 and 360,070."

"III. The alleged amendments of April 26, 1890, and all of later date are 'enlargements' and not amendments."

"IV. The claims were designedly made far too broad, and must be construed to cover (*a*) the double use, and (*b*) a relief valve whether controlled by a piston or its equivalent, or controlled in any other way, known or unknown."

Most of the claims in support of the second defense have already been discussed. But as they are forcibly renewed upon a different aspect, and in a different connection in this case, they seem to call for a further consideration.

The Divisional Patent Represents a Patentable Invention.

Irrespective of the questions of the effect of the so-called amendments, and the action of the Patent Office thereon, which will hereafter be considered, it sesms to me that this divisional patent fairly represents an invention distinct from those which preceded it. The problem presented was how to provide for a certain, sure operation of the emergency valve, and how to rapidly apply brakes for an emergency stop, or by means of an emergency reduction of pressure.

The solution was accomplished by a valvular appliance so arranged as to operate independently of the triple valve, although capable of being used in combination with it.

The essence of the invention lies in providing a means whereby the emergency apparatus may be directly brought into efficient operation, although the triple valve may be stuck fast.

I do not find in the argument of defendants any thing which renders it necessary again to discuss patents Nos. 162.465 or 360,070, nor do I see any reason for changing the views already fully stated, that the patent No. 376,837 embodies a valuable invention, and that the patent, therefore, is valid.

The domain of the conception, assisted by complainants' counsel, consists in the elimination from the apparatus of patent No. 448,827 of all mechanical connection between triple valve and emergency valve, whereby the movements of the latter may be controlled by the former.

The distinct invention in patent No. 448,827 is the combination of the valve with the triple-vavle mechanism under such relations that it does not need any movement on the part of the triple-valve mechanism in order to operate it.

The Three Westinghouse Quick Action Patents Embody the Various Forms of the Invention.

If the invention embodied in patents Nos. 360,070, 376,837 and 448,827 be considered in its entirety, we shall see that it is for the fluid pressure car brake, consisting of various combinations, operating in different ways. The object to be attained by such invention is the successful practical operation of the brakes on all occasions. One of the exigencies to be guarded against in providing for all contingencies is the possible sticking or wedging of the triple valve. While, therefore, the apparatus covered by patent No. 448,827 is adapted to be used in connection with the triple valve device and in combination with a brake apparatus normally operated by such device, yet it is designed to be so constructed that upon a considerably greater reduction of pressure than that required for a service stop the pressure from the reservoir on top of the diaphragm will cause it to work in any case. By this means the mechanical dependency of the emergency part of the apparatus upon the movement of the other part is eliminated.

This subject will be further discussed in the consideration of said claims.

The defendants claimed, in connection with the proceedings in the Patent Office, that Westinghouse falsely swore that said improvement had not been patented with his knowledge or consent, and that his application did not contain any description of the invention patented in patent No. 448,827 until after he had knowledge of the apparatus made by defendants, and that because of such knowledge he made the alleged amendments.

The first point was not referred to in the briefs or arguments of counsel for defendants. Even if true, it does not seem to be material (Hoe vs. Cottrell, 17 Blatchf., 546). The second point is unsupported by proof. It was not pressed upon the argument of the case. The record shows that the second claim for the combination with a triple-valve mechanism of a "discharge valve," etc., was made before any record evidence of the existence of defendants' valves. I, therefore, have not considered the matter.

The Defendants Claim that Certain Amendments Were Merely Enlargements.

The history of the patent is important in the consideration of the defenses that the alleged amendments are enlargements and not amendments.

I understand counsel to mean by enlargement such an alteration of the claim of a patent as to enlarge the scope of, or make a total change in, the invention as originally described.

It appears from the evidence, and is agreed by the parties, that fig. 1 of patent No. 448,827 was originally fig. 13 of Patent No. 376,837, and that patent No. 448,827 contains a paragraph which was originally in patent No. 376,837.

In the original application, therefore, as a part of patent No. 376,837, the subject matter of this divisional patent was described in connection with a triple-valve apparatus.

It further appears that when patent No. 448,827 was first applied for there was but one sheet of drawings and but one figure, which is fig. 1 of the present patent, and that the new sheets were inserted in compliance with an express requirement of the Patent Office.

It is further agreed that the record does not disclose any action of the Patent Office, requiring or requesting that fig. 13 of patent No. 376,837 should be taken out of that application.

It further appears, from the file wrapper and contents, that in the original specification of this divisional patent, the valve mechanism therein claimed was described as capable of being employed in connection with, and supplementary to, the automatic triple-valve apparatus, although it was not claimed as so connected. Afterward, on citation of anticipations, the claims were amended so as to be restricted to a combination of triple valve and emergency valve apparatus.

The Amendments Were Within the Rights of the Inventor and Were Not Enlargements.

If the original apparatus was an invention and was described as capable of use independently or in a combination, I do not see how a subsequent amendment, restricting the claim to such combination, can constitute a new invention.

The combination was not one where the triple valve and emergency apparatus acted together in ordinary braking, but one wherein the latter was only operated by a greater than normal reduction of pressure, without requiring for such operation any movement or cooperation on the part of the triple-valve device. It seems to me that the inventor acted clearly within his rights under the law in this regard, and that said amendments were not enlargements of the invention already described.

In Railway Register Co. vs. North Hudson Co., 24 Fed. Rep., 793, Judge Nixon said :

"The question is not, as the counsel of the defendants seem to imagine, whether everything which appears in these three claims was incorporated in the fifth claim of the original application, but whether the specifications of that application fairly indicate all that was put into these claims. I do not understand that an inventor applying for a patent, and before it is issued, may not amend or enlarge his claim from time to time, in order to embrace everything which was specified at the start."

To the same effect is Singer vs. Braunsdorf, 7 Blatchf., 521.

In cases of reissue I find the rule laid down as follows: "It must appear by the description in the original patent that it was the purpose of the patentee to secure the thing specified in the claim of the reissue."

Featherstone vs. Bidwell Cycle Co., U. S. App., 1893.

A reissue must be for the same invention intended to be embraced in the original patent, and cannot be substantially changed, either by the addition of new matter or the omission of important particulars, so as to enlarge the invention, as intended to be originally claimed.

Pattee Plow Co vs. Kingman, 129 U. S., 299.

"If the amended specification does not enlarge the scope of the patent by extending the claim so as to cover more than was embraced in the original, and thus cause the patent to include an invention not within the original, the rights of the public are not thereby narrowed, and the case is within the remedy intended by the statute."

Eames vs. Andrews, 122 U. S., 40.

See, also,

Leggett vs. Standard Oil Co., 149 U. S., 287.

Railway Reg. Mfg. Co. vs. Broadway & Seventh Ave. R. R. Co., 26 F. R., 522.

If the rule laid down in the foregoing cases be applied herein, and the original specification contained in patent No. 376,837 and in the original divisional application, be examined and compared with the claims in suit, it will be found that all the elements and the combination covered by said claims were described in, or embraced within the scope of, said original specification.

Consideration of the Question Whether the Claims of the Divisional Patent Represent Combinations or Mere Aggregations.

The considerations already suggested seem to raise a question as to the co-operation of the elements of the combination as claimed.

Where subordinate "elements are so united that, by their reciprocal influence upon each other, or their joint action on their common object, they perform additional functions, and accomplish additional results, the union is a true combination" (Robinson on Patents, 155).

Whether the elements act successively or simultaneously is of no consequence, provided they coact to produce a new and useful result in accordance with the co-operative law described in the claim (Robinson on Patents, 156; Holmes Burglar Alarm Co. vs. Domestic Tel. Co., 42 Fed. Rep. 220).

In Hoe vs. Cottrell, 1 Fed. Rep., 597, Judge Shipman sustained the patent for a combination because the beneficial results, involving a new mode of operation, were "the product of the successive action of all the elementary parts."

Newbury vs. Fowler, 28 Fed. Rep., 454, holds that a claim for supplemental mechanism so adapted to a time lock as to remain inert until the time lock was broken, and to be brought into action by such breaking, is a valid claim for a combination.

Edison Electric Light Co. vs. Westinghouse, *supra*.

The Combination Is a True One and Not a Simple Aggregation.

In this combination, when the slide valve of the triple valve gets stuck, instead of acting as a port, it acts as a plug to the port, and thereby causes the emergency valve to be directly operated through its own passageway, between the train pipe and the brakes, by the direct reduction of pressure by the engineer. In this view, at least, the parts may be fairly said to act separately to contribute to a unitary result. Such co-operating action is confessedly found in the function of speeding the action of the next succeeding triple valve.

Furthermore, the combination is not denied by the expert or counsel for defendants.

In Yale Lock Mfg. Co. vs. Norwich Nat. Bank, 6 Fed. Rep., 395, the Court, speaking of the independent action of the time lock and bolt lock, says: "Each mechanism strengthens the weakness of the other, and, by its positive advantage, fills up the deficiencies of the other. The result is a product of greater efficiency than is fairly represented by the sum of the two results. The result is not a combination of two results, but a result from the combined action of two locks upon the bolt work, each acting independently, but the action of each supplying the lack of the other."

The considerations already stated would seem to cover all the defenses raised by defendants.

The Divisional Patent Covers a Useful Invention.

This patent covers a useful invention. Some such contrivance would seem to be indispensable to the practical operation of the system in emergencies. But in view of what Westinghouse had already done, it has seemed to me that the history, construction and claims of this patent, and the state of the art, should be critically examined.

The questions involved herein were most forcibly presented by the ingenious and able arguments of counsel.

In the consideration of these questions, I have had in mind the limitation suggested by Judge Shipman, in delivering the opinion of the Circuit Court of Appeals in Brush Electric Co. vs. Brush-Swan Co., 1 U. S. App., 562, where he says: "When one inventor makes a generic invention and also subordinate specific inventions, and presents the whole series in a set of contemporaneous applications, the patentee must not be enabled by an ingenious use of general terms to enlarge the boundaries of each invention, to extend each into the borders of another, and obtain a series of overlapping patents."

The Improvement Embodied in the Divisional Patent Was a Useful One and Involved Invention.

But I am forced to the conclusion that George Westinghouse described, in the original specification of this patent, an improvement upon previous inventions, which was capable of use independently, or as part of a combination, but which owed its utility in such combination to its independency of operation in emergencies, in supplying the lack of the other part of the combination, and that this useful element involved invention, in order to adapt it to such combination, and to the exigencies of the automatic quick-action freight brake system.

Description of the Invention Covered by the Park Patent.

In suit No. 4,976 it is claimed that defendants, by their first form of quick-action triple valve, have infringed claims 1 and 2 of patent No. 393,784, granted to Harvey S. Park, Dec. 4, 1888. This patent having been assigned to the Westinghouse Air Brake Company alone, its alleged infringement is, for that reason, made the basis of a separate suit.

The essence of this invention is the combination of elements for operating the separate emergency valve by train-pipe pressure instead of by auxiliary reservoir pressure, as in patent No. 376,837.

This result was accomplished by providing a separate emergency piston and valve, ordinarily exposed to train-pipe pressure, above said piston, which pressure served to hold the valve on its seat, and was not affected by ordinary reductions of pressure for service stops.

But the considerable reduction of pressure necessary for an emergency-stop caused air from the train pipe to be vented into the space below said piston, equalizing the pressure on both sides, and acting on the under side of said valve, causing it to be unseated, and to thus allow the train-pipe pressure to be vented directly into the brake cylinder.

Claims of the Park Patent.

The claims alleged to be infringed are as follows :

"1. In a brake mechanism, the combination of a valve controlling the direct passage of pressure from a train pipe to a brake cylinder, a piston connected to said valve and actuated wholly by train-pipe pressure, and a valve controlling the train-pipe pressure on the piston for opening and closing the communication between a train pipe and a brake cylinder through the direct action of train-pipe pressure, substantially as specified."

"2. In a brake mechanism, the combination of a train pipe, a brake cylinder, an interposed chamber communicating with the train pipe and brake cylinder a piston in said chamber, a piston stem, a valve on the piston stem controlling the passage from the interposed chamber to the brake cylinder, and a controlling valve and passages for the admission of pressure from the train pipe to move the piston and open the valve, substantially as and for the purposes specified."

It does not seem necessary to further consider the details of construction of this device, whereby the emergency apparatus is called into operation, because they are not material to the defense of non-infringement.

The Defendants' First Quick-Action Triple Valve Operates Differently from That of Park.

The defendants' first form of quick-action triple valve contains all the elements specified in said claims. But the piston of the emergency valve, in the first claim of said patent, is claimed as "connected to said valve, and actuated wholly by train-pipe pressure."

It will be remembered that in defendants' said device there are two pistons which operate the emergency apparatus instead of the single emergency piston ton of patent No. 376,837, and of the patent in suit. Of these two pistons, the one which corresponds in construction with the single emergency piston of the patent in suit, and which may, therefore, be called defendants' emergency piston, is not fastened to the emergency valve, but merely presses upon it through its spindle, which rests on top of said valve.

From this difference in construction there results a difference in the operation of the two devices.

In complainants' device said valve is held to its seat by train-pipe pressure on one side of said piston, and, upon an emergency application is unseated by means of train-pipe pressure admitted to the other side of said piston.

Defendants' Piston Not Connected to Emergency Valves Nor Operated Wholly by Train-Pipe Pressure.

In defendants' device upon an emergency application, train-pipe pressure upon the emergency piston causes it to unseat said emergency valve. But, as said piston stem is not fastened to said valve, train-pipe pressure on the under side of said piston does not close said valve but it is seated by combined spring, train-pipe, brake-cylinder and auxiliary reservoir pressure.

These differences are material only upon the question whether the defendants have the "piston connected to said valve and actuated wholly by train-pipe pressure," covered by complainants' first claim, so that train-pipe pressure, acting first on one side of said piston and then on the other side, would operate said valve.

"Connected to" means "bound or fastened together"; "united or joined or coupled to," like a "connecting-rod" (Century Dictionary). I do not think defendants' piston is "connected to" the valve in a mechanical sense. It is certainly not so connected as to close the emergency valve.

Defendants' Quick-Action Triple Valve Does Not Infringe the Claims of the Park Patent.

It, therefore, seems to me that said device does not infringe said first claim.

McClain vs. Ortmayer, 141 U. S., 419.

In the second claim Park does not claim the piston connected to said valve, and actuated wholly by train-pipe pressure, but claims "a piston stem, a valve on the piston stem controlling the passage from the interposed chamber to the brake cylinder, and a controlling valve and passages for the admission of pressure from the train pipe to move the piston and open the valve, substantially as and for the purposes specified."

The description shows that the said valve is controlled in both opening and closing by train-pipe pressure admitted into the piston chamber above and below the piston, and moving the piston. Now, if the valve were disconnected from said piston, as in the first form of defendants' quick-action triple valve, said train-pipe pressure, acting on the piston, would not close the valve, because the piston would have no control over the valve.

Applying the considerations already suggested, as to the scope of the claim, it seems to me that the construction described by the patentee embodies as an essential to its successful operation a valve connected to said piston, and that, therefore, it must be covered by said second claim.

Robinson on Patents, 523.

Ex parte Richardson, 7 Off. Gaz., 1053.

Inasmuch as the means employed by defendants thus differ from those described and claimed as essen

tial in the patent in suit, it seems to me that the complainants' patent is not infringed.

I am, therefore, of the opinion that defendants' first form of quick-action triple valve does not infringe said second claim.

It is not claimed that defendants' second or modified form of quick-action apparatus infringes said claims.

Description of the Invention Embodied in Patent No. 172,064.

Complainants, in suit No. 4,977, further allege infringement of claim No. 3 of patent No. 172,064 issued to George Westinghouse, Jr., Jan. 11, 1876, for an Improvement in Air-brake Valves.

This invention was designed to be used in connection with the form of automatic brake apparatus employed prior to the invention of the quick-action apparatus. The object of the invention was to provide means for the application and release of the brakes, by the direct admission of air from the brake pipe to the brake cylinder.

The patent in suit is for an improvement on No. 168,359, granted to said Westinghouse, Oct. 5, 1875.

Character of the Defense.

The defense is non-infringement, chiefly on the ground that the defendants have adopted the construction of the said original patent, which is not in suit.

I shall, therefore, consider these patents together.

Patent No. 168,359 provides for a piston and slide valve so arranged that air pressure transmitted through the train pipe shall press on the under side of the piston and hold it in an upward position, and thence pass through a side port in the piston valve case and certain other ports and passages into the auxiliary reservoir.

The effect of this pressure is to hold the slide-valve in position above two connected ports, one leading to the brake cylinder, the other to the open air, so that any pressure in the brake cylinder will escape to the open air, and the brakes will be off. When the pressure is reduced in order to apply the brakes, the back pressure from the auxiliary reservoir depresses said piston so that it passes down and closes the supply ports and shifts the slide valve so as to open the port leading to the brake cylinder and expose it to auxiliary reservoir pressure, and so as to close the port leading to the open air.

In patent No. 172,064, the inventor dispensed with said side port in the valve case and substituted therefor a port through the piston itself. The piston was so arranged, in connection with this port, that said port could be opened or closed without moving the slide valve. This was accomplished by having the stem of the piston fitted to the port in the piston, so that it would close the port when moved into it, and open it when removed, and by further providing that the slide valve should be made shorter than the distance between the collars on its stem, thus insuring the necessary slack motion for closing the supply port before the slide valve begins to move.

The Claim Alleged To Be Infringed.

Claim 3 is as follows:

"3. The slide-valve H, made shorter than the distance between its end bearings, in combination with the port s and stem c^1 relatively arranged with reference to the operation of the valve H while the port s is closed, substantially as set forth."

Defendants' device, as illustrated by "Defendants' Plain Triple Valve," contains the slide valve, made shorter than the distance between its end bearings on the piston stem. It is also provided with two ports, one of which leads from the train pipe through the piston chamber and by other passages to the auxiliary reservoir. The other port leads from the auxiliary reservoir to the brake cylinder. This port is closed by having the end of the piston stem slide on to it and cover it like a valve upon its seat.

There is no port through defendants' piston, and consequently no piston stem fitted to enter such port.

The two combinations are so arranged as to provide the lost motion in the same way, and to close the supply port before commencing to open the slide valve, and without having to overcome any resistance from the slide valve.

Contention of the Defendants.

But defendants contend that the port leading from the train pipe to the piston chamber is the equivalent of the port s in complainants' claim that this is the side port of patent No. 168,359, and that patent No. 172,064 was designed to get rid of a side port, and substitute a central port.

The inventor states that his invention dispenses with the side port, which is found in defendants' device, and in patent No. 168,359, and substitutes therefor a port directly through the center of the piston. And the claim in suit is for a combination of valve, port and stem, "substantially as described."

The defendants accomplish the same result by a combination which contains a port not through the center of the piston which does not connect the train pipe and the auxiliary reservoir, but does connect the auxiliary reservoir with the brake cylinder, while the port in their device, which connects the train pipe with the auxiliary reservoir, is the side port of patent No. 168,359, which was dispensed with in patent No. 172,064.

Objections to the Position of Complainants.

Two further objections are suggested to the claim of complainants that the end port, between the auxiliary reservoir and the brake cylinder, is the equivalent of their port through the center of the piston.

In the operation of complainants' device the single port is open for the free passage of air from the brake pipe to the auxiliary reservoir, when the train is in running condition, and is closed to apply the brakes. In defendants' device the side port is closed and the end port is then opened to apply the brakes.

Furthermore, the stem of complainants' device is so arranged as to close the central port in the piston, by entering it while the piston is still free to move, while in defendants' device the moment the piston stem strikes the end port, and covers it, the motion of the piston is arrested.

Claim 3 of Patent No. 172,064 Not Infringed by Defendants' Device.

I do not decide the question, however, upon these grounds. But, inasmuch as complainants claim a combination which contains a port through the centre of a piston, described as substituted for a side port, with which said improvement dispenses, and as defendants' device depends upon the use of a side port, and has no port through the piston, but if made up by a combination of different elements, which are admitted in patent No. 172,064 to be part of the prior art, the combination claimed in Claim 3 of said patent is not infringed.

A correct construction of the claim must include the port through the center of the piston, substituted for the side port of patent No. 168,359.

Perrin vs. Manhattan R. R. Co., 56 Fed. Rep., 503.

The defendants had the right to use other parts of the combination claimed, provided they substituted for the port through the piston another mechanical structure substantially different in its construction and operation, although it served the same purpose.

Eames vs. Godfrey, 1 Wall., 78.

The patentee is bound by the explicit language of the claim.

McClain vs. Ortmayer, *supra*.

Description of Engineer's Brake Valve of Patent No. 222,803.

In suit No. 4,976, complainants also allege infringement of patent No. 222,803, granted to George Westinghouse, Jr., Dec. 23, 1879, for an Improvement in Operating-Cocks for Fluid-Pressure Brakes.

This device is known as the engineer's valve. It is intended to be operated by the engineer on the locomotive engine "to admit the fluid pressure to the brake-pipes and cylinders, fast or slow, as may be desired; to cut off automatically or stop such admission of fluid pressure; to hold or retain automatically such pressure, with little or no increase or diminution, and also to permit the escape of the fluid pressure previously admitted or charged into the brake cylinders, and it is important, for convenience in use, that all these functions be performed by movements of a single stem handle, lever or crank, so that, so far as the working of the device is concerned, the engineer need give his attention to but a single device."

The contrivance described in the patent consists of a piston case, containing a piston, governing a charging valve held up to its seat, partly by fluid pressure and partly by a spring, and an escape valve held down to its seat partly by gravity and partly by a preponderance of fluid pressure on its upper end.

This governing piston is exposed on its under side to fluid pressure, and on the upper side to pressure from a spring. A screw-stem, worked by a crank-arm, is so arranged in connection with said spring that, by the revolution of the crank-arm, the downward pressure of said spring upon said piston is increased or lessened.

The effect of such change of pressure is to cause the piston to be moved upward or downward, according as it is acted upon by an excess of fluid or of spring pressure, and to open or close the charging and escape valves.

Beneath the lower end of the escape valve, provision is made for a certain amount of slack motion, so that the governing piston may be moved up or down for a short distance without unseating the escape valve. The effect of this arrangement is to prevent the possibility of both valves being open at the same time.

Operation of the Engineer's Brake Valve of Patent No. 222,803.

The operation of said apparatus is as follows:

In order to apply the brakes or to open the charging valve the crank arm is screwed down, and this increase of pressure, transmitted through the stem of the piston head to the charging valve, unseats it, and permits fluid pressure to pass from the boiler or storage reservoir to the train pipe and brake cylinders.

The fluid pressure also passes upward to the space below the piston head, and exerts the same pressure upon it as in the train-pipe or brake cylinders.

The engineer knows from his engineer's gage just how far to screw down his crank, so that, when the necessary amount of pressure has passed through to the train pipe or brake cylinder, the same pressure will automatically lift the piston and close the charging valve.

The crank arm is screwed up in order to open the escape valve, and after the proper amount has been discharged, the escape valve automatically closes in the same way as already shown in the case of the charging valve.

Claims Alleged To Be Infringed by Defendants' Engineer's Brake Valve.

Complainants claim infringement of claims 2, 3 and 4 of said patent. Said claims read as follows:

"2. As a means for automatically cutting off the fluid-pressure supply when the desired pressure has been charged into the brake cylinders, a piston head P, movable by the operative brake pressure or any excess thereof, in combination with the charging valve and a connection from one to the other, substantially as set forth, whereby such movement of the piston head will result in the automatic closing of the charging valve substantially as set forth."

"3. The combination of piston head, charging valve, interposed stem and escape valve, substantially as set forth with reference to the opening and closing of the charging valve, without necessarily opening the escape valve, substantially as set forth."

"4. The combination or piston head, charging valve, interposed stem, escape valve and a single operating stem, adapted by independent connections with both valves to shift both by independent successive motions, substantially as set forth."

Description of Defendants' Engineer's Brake Valve.

Defendants' engineer's valve has a single operating lever and stem, which is worked by moving a handle having a reciprocating motion, from one side to the other. It also has a piston case, containing a piston, governing a charging and an escape valve, so arranged that, acting together, they have practically the same functions as complainants' valve. The governing piston is exposed to fluid pressure on both sides. It is also acted upon from below, by a bell crank lever, or bent lever with vertical arms, connected by links to said piston, and to a second lever, which second lever is connected with a light spring, the resistance of which corresponds to a uniform variation in the pressures on the opposite sides of said piston as it rises.

Character of the Defense Disclosed.

The marked difference, as claimed by defendants, between the two contrivances is that, while in complainants' device the turning of the crank-arm compresses or relaxes a spring, in defendants' device the moving of the handle directly and positively opens the valve without the interposition of a spring. This is accomplished by having the main lever, which is fastened to said handle, carry an eccentric pin, which passes through said lever, and which moves in the arc

of a circle. The right end of the lever is held stationary by a jaw and fulcrum pin; the left end, when said handle is moved to the right, is lifted by the rock-shaft motion imparted by said pin, and strikes against another pin attached to the escape valve, and raises and opens said escape valve. This lever has also an upper jaw, which moves in a pin attached to a bell-crank lever, the arm of which is directly beneath the charging valve. In order to open this valve, the handle is open to the left, which causes the main lever and pin to move to the left, and to raise the arm of the bell-crank lever and open the charging valve. Provision is made for slack motion by a space between the top of the escape valve and said pin attached thereto, whereby the left end of the main lever is permitted to have a certain amount of play before it strikes said pin.

In view of these alleged differences of operation, the defendants deny infringement.

The complainants support their contention by a consideration of the features embraced in their claims, which are common to the two combinations; the defendants rely upon the difference in construction and operation.

Discussion of the Rights of the Complainants, Under Patent No. 222,803.

It appears that George Westinghouse, Jr., was the first inventor of an engineer's valve wherein the charging and exhaust valves could be automatically closed. It is necessarily an important element in the operation of the fluid-pressure brake system, because it sets in motion and controls all the other appliances of said system. Even if originally designed for the direct system, it was described by the inventor as capable of being applied to other systems, and it has been successfully used to operate automatic brakes in regular service.

The essential result which the inventor seems to have intended was not, as claimed by defendants, "that the piston shall be pushed in one direction by train-pipe pressure, and in the other direction by a spring only, and that the tension of the spring shall be variable by means under control of the engineer." The spring is not mentioned in any of the claims alleged to be infringed. The essential result aimed at and accomplished was the operation of both valves by a single stem, and their automatic closing, after said operation had accomplished the desired result. The claims show the combinations embodied in the invention.

In this connection, reference may be made to the defense that all the elements of these combinations were old, because shown in the patents No. 129,015, granted July 16, 1872, to Messrs. Fay and Cairns, and No. 141,685, granted Aug. 12, 1873, to said Westinghouse.

The former patent is for an apparatus for regulating the supply of water and preventing the bursting of pipes in houses. The latter patent is for a triple valve. An examination of these patents confirms the admissions, made by defendants' expert, that neither of the structures is capable of performing the functions of the patent in suit, or could be substituted therefor. In view of these admissions, and of the manifest invention involved in the combination of the single elements described in said patents with other elements, and in their adaptation to manual operation for totally different purposes, I have not considered it necessary to consider the construction of said patents in detail.

Comparison of the Defendants' Device with the Claims in Suit.

Returning now to the invention embodied in the patent in suit, and bearing in mind the object which the inventor had in view, let us compare the claims in suit with the apparatus of defendant.

The piston head, the charging and escape valves, the interposed stem, and the single operating stem, of said claims, are all to be found in defendants' apparatus.

Their combination to form a device for admitting fluid pressure to the train pipe, and automatically cutting off the supply, while retaining the necessary operative fluid pressure, and, by means of such a connection between said single operating stem and said valves, that independent successive motions of said handle shall move them independently of each other, is also found in defendants' apparatus.

In each, the piston automatically closes the escape valve when the desired pressure is reached, and in each the piston is movable by operative brake pressure, or any excess thereof, as specified in claim 3 of the patent in suit.

But the elements of defendants' device differ from those of complainants in the following particulars:

The piston head of defendants, as already stated, is exposed to fluid pressure alone on one side, and to fluid pressure, plus a spring, on the other side, while in complainants' structure the piston head is exposed to fluid pressure only on one side, and to spring pressure on the other side.

The defendants' device positively and directly opens the valves, as they claim; complainants' device pushes the spring which opens it.

It is not necessary to determine whether the fluid pressure is the equivalent of the spring, because the presence or absence of the spring seems to be immaterial, it not being claimed as an element of the combination. The essential similarity seems to consist in the fact that, in each contrivance, fluid pressure is always practically constant on one side of the piston, and the movement of the piston is regulated by the variations of pressure on its other side, and, in each case, the piston automatically closes the escape valve when the desired pressure is reached.

Defendants' valve is an operative device without the use of the piston. It would only be necessary for the engineer, after he had sufficiently reduced the pressure by opening the exhaust valve, to move the handle back and close it, and *vice versa*. The piston is essential to the operation of complainant's device.

Defendants' device has, also, a greater capacity for automatic closing of the escape valve than that of complainants.

It follows, from the above differences, that, in the operation of complainants' apparatus, the engineer has no control over the valves except by moving the abutment on the spring.

Defendants' Engineers' Valve May Be an Improvement Upon the Valve of the Patent in Suit, but Appropriates the Invention.

But, while in these respects the device of defendants may be an improvement upon that of complainants, it does not seem to me to show that defendants have not appropriated the invention of complainants.

It is well settled that one has no right, in making an improvement on another's device, to appropriate his invention.

III. Robinson on Patents, § 894, and cases cited.

Substantial Admission of Infringement by Defendants' Expert.

Furthermore, one of the experts for defendants testifies as follows on cross-examination:

"Cross.-Int. 28. Referring you to defendants' engineer's valve, as shown in plates 2 and 3 of defendants' catalogue, is it not the fact that you find therein a shell or case marked '31, 38, 40 and 41,' and containing a piston chamber closed at top by the head 41, and a valve chamber closed at top by the cap 38?

"Ans. Yes.

"Cross-Int. 29. You also find in it, do you not, a piston head 32, adapted to work in the piston chamber, and to be moved by the operative pressure or any excess thereof?

"Ans. Yes.

"Cross-Int. 30. You also find therein, do you not, a harging valve 39?

"Ans. Yes.

"Cross Int. 31. You also find therein, do you not, a connection between the piston head 32 and charging valve 39, consisting of a bell-crank lever 49, a pin 48, a lever 43, and a stem or projection on the piston head 32?

"Ans. Yes.

"Cross-Int. 32. You also find, do you not, that in defendants' engineer's valve, by reason of the connection from the piston head to the charging valve, movement at the piston head, under the operative pressure or any excess thereof, will result in the automatic closing of the charging valve?

"Ans. Yes.

"Cross-Int. 33. You also find, do you not, in defendants' engineer's valve a piston head 32, a charging valve 39 and an escape valve 42, and interposed connections 49, 42 and 48, so arranged that the charging valve may be opened and closed without necessarily opening the escape valve?

"Ans. Yes."

The effect of this testimony seems to be to admit that substantially all the elements of complainants' claims are found combined in defendants' engineer's valve, except the "single operating stem adapted, by independent connections with both valves, to shift both by independent successive motions." The stem of defendants' device which corresponds with this claim is the spindle of the handle, the eccentric pin, and the lever which opens the escape valve. It performs the same functions as are claimed in the patents. It accomplishes the same results. That it is a handle, spindle and lever, instead of a single stem, is immaterial, for the patentee says, in his description, that these funtions may be performed by a single stem handle, lever or crank. The essential thing about this part of the invention, as stated by the patentee, is that "the engineer need give his attention to but a single device."

Ingenuity of the Defendants in Attempting to Evade Infringement.

A careful examination of the testimony, and comparison of the claims 2, 3 and 4 of the patent in suit with defendants' engineer's valve, and consideration of the close and accurate analysis of the differences between them, made by the counsel for defendants, seems to show that defendants have contrived and constructed a most ingenious device, apparently in some respects superior to that of complainants. They have evidently sought to avoid infringement of complainants' patent, and have succeeded as to some of its claims. With this end in view, they have constructed an apparatus which is, in appearance, utterly unlike that of complainants, and in which the parts are so relatively combined that they either appear to act, or do act, differently from the corresponding parts of the patent in suit.

But it seems to me that the apparent differences of operation result either from the use of mechanica equivalents, as in the case of the handle and levers, instead of the crank and screw, or in different relative arrangement of the parts toward each other, as in the case of the screw or the motions of the valves in opposite directions.

The actual differences, such as the greater automatic action, direct and positive opening of valves and operativeness of apparatus independent of the piston, as found in defendants' devices, are matters not covered by the claims in suit, not essential to the accomplishment of the results aimed at in the invention, and not necessarily involved in or excluded from the operation of complainants' invention.

On the other hand, the elements which are common to the combination claimed by complainants and to defendants' device, are the vital elements essential to the operation of the patent and to the achievement of the result sought to be accomplished, namely, the combination of piston head, stems, charging and escape valves arranged so as to be independently operated by the engineer, by a single contrivance and so as to automatically close when the desired pressure is reached.

Defendants' Engineer's Brake Valve Is an Infringement.

And, because of these conclusions, supported by the admissions of defendants' expert that the device of defendants contains the elements combined, as claimed by complainants, I am of the opinion that defendants' device infringes claims 2, 3 and 4 of patent No. 222,803.

"Though there are differences in the form and structure of the intermediate mechanism, tending to simplicity, and, perhaps, improvement, and in the form of the casting mechanism, still each of these mechanisms, as it is embodied in the defendants' machine, performs the same function as the corresponding mechanism in the Mergenthaler machine, in substantially the same way, and they are combined to produce the same result. The combination which is covered by the claim is the same in both." (Judge Lacombe in National Typographic Co. *et al.* vs. New York Typograph Co. *et al.*, 46 Fed. Rep., 114).

An Injunction and an Accounting Ordered in the Case of Each Style of Quick-Action Triple Valve and the Engineer's Brake Valve of the Defendants.

In suit No. 4,976 let a decree be entered dismissing the bill as to patent No. 393,684, and for an injunction and an accounting as to claims 2, 3 and 4 of patent No. 222,803.

In suit No. 4,977 let a decree be entered dismissing the bill as to claim 3 of patent No. 172,064, and claim 6 of patent No. 376,837, and for an injunction and an accounting as to claims 1, 2 and 3 of patent No. 376,837.

In suit No. 5,315 let a decree be entered for an injunction and accounting.

INDORSED: Circuit Court of the United States for the Southern District of New York. Geo. Westinghouse, Jr., *et al.* vs. The New York Air Brake Co. *et al.*; The Westinghouse Air Brake Co. *vs.* Same. Opinion. TOWNSEND, J. Filed Nov. 20, 1893.]

THE WESTINGHOUSE AIR-BRAKE COMPANY

is now prepared to fill orders at an hour's notice for one or one thousand sets of AIR-BRAKES FOR FREIGHT CARS, having at their new works an annual capacity for turning out air brakes

—FOR—

250,000 Freight Cars,
6,000 Passenger Cars,
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350,000 Freight and Passenger Cars and
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Decision of Judge Townsend Refusing to Suspend the Injunction Granted Against the New York Air Brake Co.

United States Circuit Court

FOR THE SOUTHERN DISTRICT OF NEW YORK.

GEORGE WESTINGHOUSE, JR., AND THE WESTINGHOUSE AIR-BRAKE COMPANY *vs.* THE NEW YORK AIR-BRAKE COMPANY, ET AL.	In Equity. No. 4,977.
THE WESTINGHOUSE AIR-BRAKE COMPANY *vs.* THE NEW YORK AIR-BRAKE COMPANY, ET AL.	In Equity. No. 5,315.

TOWNSEND, District Judge:

These are motions that the injunctions, ordered on final hearing, be stayed pending the appeal to the Circuit Court of Appeals.

Defendants allege that they have now about 3,000 car equipments finished and in process of completion, which comprise a plain triple valve with emergency attachments; that the plain triple valve is public property; that the cost of the emergency attachment is only one-fifth of the cost of the entire equipment; that such equipments cannot be altered; that, if sold for use, defendants will realize $120,000, but, if the sale be enjoined, they cannot realize as much as $20,000. They further claim that the profits, which the complainant company would lose by being deprived of the sale of the same number of quick-action triple valves of their own manufacture, would not exceed $5 per valve. It does not appear that any of these equipments were manufactured until after the commencement of these suits, nor that the defendants are now under contract to supply any of said equipments to any one.

The complainants allege that the defendant, the New York Air Brake Company, is a mere paper corporation, possessing no property other than its patents and such unsold apparatus as it now has on hand; that it had only put a very few sets of brakes on the market prior to the first of these suits; and that its conduct in causing to be manufactured, and in selling, infringing brakes, and in cutting under prices, during the pendency of these suits, has caused, and that to permit it so to do until their final determination would cause, incalculable damage to complainants.

It appears that complainants have adequate facilities for supplying the entire market with apparatus covered by the patents in suit, and that they have never granted any licenses to others to manufacture such apparatus.

The complainants have not been guilty of laches.

The question of the disposition of these motions is addressed to the sound discretion of the Court. The exercise of this discretion is to be governed by such an application of the rules of equity, in view of the circumstances of the case, as will best promote the ends of justice.

In view of the foregoing consideration, I do not feel justified in granting the motions.

To permit the defendants to sell the infringing equipments at a fixed rate for each apparatus, would be to pervert the decision of the Court from an injunction into a license. It would deprive the patentee of the monopoly granted him under the law of the United States, and establish an infringing rival in a competing business.

Furthermore, as it is impossible, in this case, to estimate the damages and profits from the infringement, an injunction is complainants' only available remedy.

The motion of defendants is, in effect, that they may be permitted to make a profit of about one hundred thousand dollars out of apparatus manufactured with full notice of complainants' rights, and during the pendency of the suits in which they are now enjoined.

From the statements contained in a circular letter, sent out by defendants immediately after the filing of the opinion, and produced at the hearing on these motions, it would appear that the denial of the motions cannot operate harshly upon the defendants. In said circular they stated that, "so far as the freight triple valve is concerned, the decision is unimportant, for no principle is involved, and only trifling and unimportant changes are necessary to make our triple valve free, in view of the very narrow construction given to the Westinghouse patents by the Court."

If this statement does not apply to the equipments on hand, they need only be held, subject to the final decision of the appellate court.

But the defendants cannot complain, if they are merely subjected to the necessity of making trifling and unimportant changes in such apparatus as they may manufacture during the intervening period.

The questions herein presented have been fully considered and disposed of by Judge SHIRAS, in denying a similar motion in Westinghouse Air Brake Co. vs. Carpenter, 52 Fed. Rep., 545.

The recent opinions of Judge GREEN in the Accumulator Co. vs. The Consolidated Electric Company, and of Judge COXE, in Lalance & Grosjean Mfg. Co. vs. Haberman Mfg. Co., 54 Fed. Rep., 375, support the view taken herein.

The motions are denied.

The defendants further claim that, inasmuch as, in suit No. 4,977, the sixth claim of patent No. 376,837 was held void, no injunction should issue except conditioned upon the filing of a disclaimer as to said claim.

The practice in this Circuit seems to support the contention of defendants. Atwater vs. Bucher, 8 Fed. Rep., 608; Campbell Co. vs. Eames Co., 44 Fed. Rep., 66; Schillinger vs. Gunther, 17 Blatchf., 66.

In accordance with said practice, let the decree, in No. 4,977, for injunction and accounting as to claims 1, 2 and 3 of patent No. 376,837, be entered upon condition that a disclaimer be filed as to claim 6 of said patent.

[ENDORSED: United States Circuit Court, for the Southern District of New York, George Westinghouse, Jr., and the Westinghouse Air Brake Company vs. The New York Air Brake Company *et al.*, No. 4,977; The Westinghouse Air Brake Company vs. The New York Air Brake Company *et al.*, No. 5,315. Opinion, TOWNSEND, J., U. S. Circuit Court. Filed Dec. 1, 1893, John A. Shields, Clerk.]

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